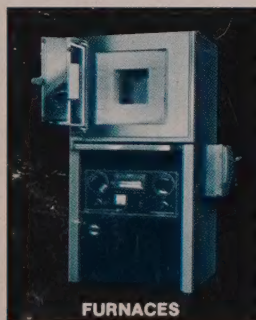
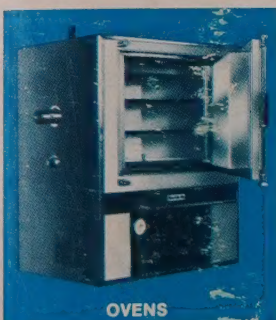
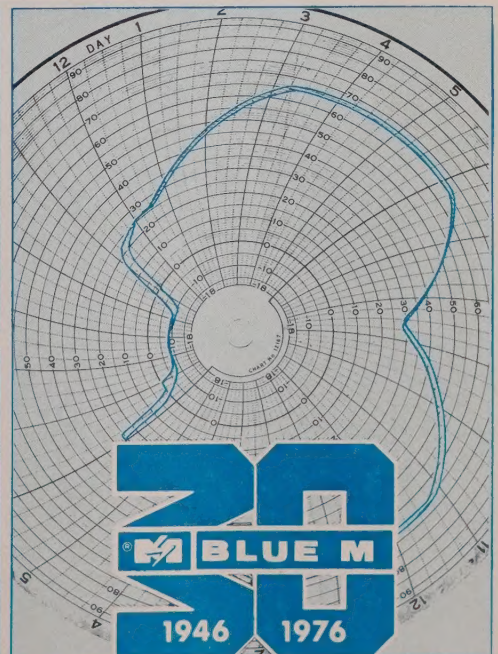
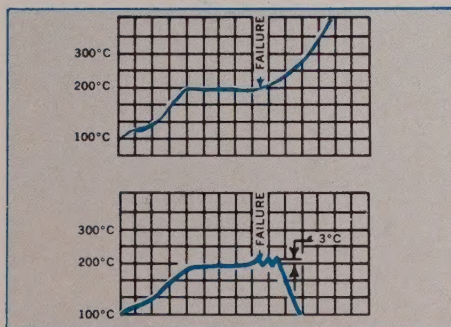
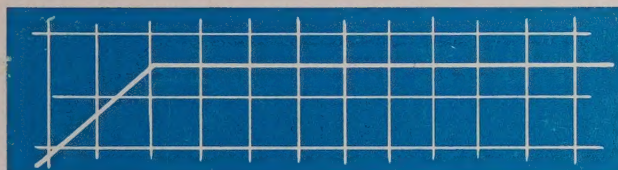
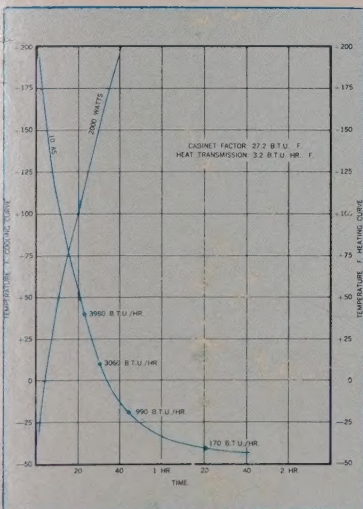
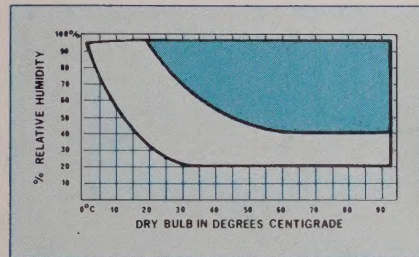


CONSTANT TEMPERATURE CONTROLLED EQUIPMENT

CUSTOM-ENGINEERED PRODUCTS
INDIVIDUALLY APPLIED
TO PERFORM SPECIFIC JOBS

MOD. - W S P - 109D - 3
S/N - W 1 - 207



**IF YOU USE, SPECIFY OR BUY TEMPERATURE
CONTROLLED EQUIPMENT . . .
THIS WILL BE THE MOST VALUABLE REFERENCE
BOOK YOU OWN!**

That's correct. This is more than just a catalog, although it's obviously that, too. This is truly a reference work designed primarily to help you evaluate and select the most modern and versatile constant temperature controlled equipment available today.

As our cover suggests, fine performance is stressed in all this equipment. We have not been content to design chambers simply because there was a market for them. We have concentrated on developing the finest equipment possible for meeting severe military and industrial needs where quality control is an overriding consideration.

For this reason, the equipment in this catalog has been designed, engineered and built with the zero-defect principle in mind. To remain competitive nationally (not to mention internationally), American enterprise must continue to strive for improved products at realistic costs. And this can come only by eliminating waste in all its forms—spoiled parts or products due to improper manufacturing/processing, lost man-hours due to indifferent safety standards or precautions, costly inefficiencies due to outmoded equipment and methods.

Accordingly, if you plan on using this book as a way to "save a buck" by finding cheap, shoddy chambers, stop right now. They simply aren't here. But, on the other hand, if "saving a buck" to you means investing in quality equipment to reduce operating costs by increasing production of better products, you're definitely in the right store. Read on.

The pages of this book are filled with descriptions of the finest chambers of their kind on the market. They have been designed to help those who know the value of quality . . . those to whom quality test/production facilities mean quality end-products. At competitive near-zero-defect costs.

Pay particular attention also, please, to the emphasis placed on safety. Not only is overtemperature protection standard on these units, but you'll find references to U.L., NEMA, N.E.C., FIA, FM, NFPA, and OSHA throughout this material as applicable. No one yet has come up with a cheap substitute for safety. Remember, too, that Blue M's patented control systems are designed to be compatible with each class of products and temperature range.

For all these reasons and many more, we say that this will be the most valuable reference book you own if you use, specify or buy temperature controlled equipment. Quality equipment, that is. We'll be happy to demonstrate why it is also—in the long run—the most economical equipment you can buy.

**DO YOU HAVE OUR SCIENTIFIC AND LABORATORY
EQUIPMENT CATALOG?**

Just as this catalog is an invaluable reference work for exotic equipment, so is our Catalog SL-178 an indispensable source of data on equipment designed for the laboratory and scientific field. Please don't confuse these books. They are separate and distinct from one another—just as the products they describe. A copy of SL-178 describing hundreds of other Blue M Ovens, Furnaces, Baths and Environmental Cabinets is available on request as well as a list of laboratory distributors nearest you.



CONSTANT TEMPERATURE CONTROLLED EQUIPMENT

ENVIRONMENTAL CABINETS
TEMPERATURE/HUMIDITY CHAMBERS
REFRIGERATED TEST CHAMBERS
THERMAL SHOCK TEST CHAMBERS

ELECTRIC OVENS
BATHS
FURNACES

*Products Designed
and Manufactured by*

BLUE M EQUIPMENT

A SALES AND SERVICE BRANCH OF BLUE M ELECTRIC COMPANY

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BLUE M EQUIPMENT

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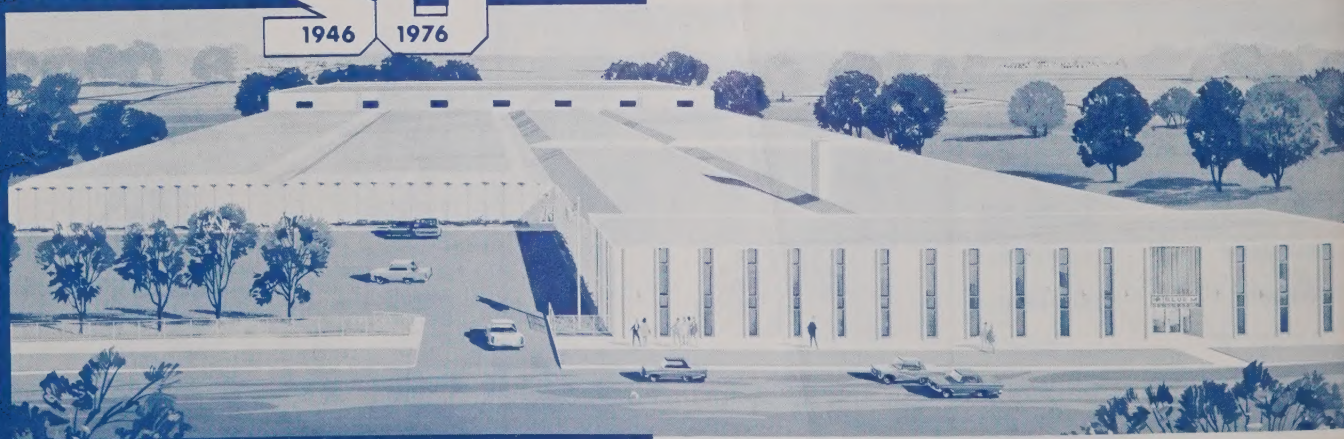
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4



30 YEARS OF GROWTH . . . in capsule form, dramatized by the pictures to the left. (1): original factory and offices of Modern Electric Laboratory, Chicago, in 1946. Total facilities occupied 2000 square feet, and were so modest that they later became the grocery store shown. Original product line consisted of four units—three ovens and a small furnace. (2.): by the beginning of 1949 the original 2000 square feet had been outgrown and the company moved to these more spacious quarters. In 1950, the company's name was changed to Blue M Electric Company. To keep pace with continued growth, a second plant (3.) was occupied in September, 1951. The company moved to its present site in Blue Island in 1954. At the time, the plant (4.) occupied 21,600 square feet—10 times the size of the original site of the company. Subsequent additions have brought the company corporate headquarters to the size shown below.



Everyone is aware of the continuing trend towards tighter quality control standards in general industry. This is particularly true in the electronics field where compliance with rigid MIL specifications, to cite just one example, has established new highs for reliability and accuracy in testing and production equipment. What was "good enough" a few years ago simply just won't do today.

This has made it virtually impossible for any one line of standard equipment—of necessity designed for broad-purpose use—to meet specialized needs.

Realizing this, Blue M Electric Company established Blue M Engineering Company as a separate division in 1960. Now known as Blue M Equipment, its purpose is to provide the design, technical sales, and service help needed to develop special equipment to meet unusual or unique requirements.

The products described in this catalog typify this ability. Some of them have been designed to serve as both test and production units, others have been developed to meet a specific test function. However, all of them draw heavily on Blue M's broad background in the design and manu-

Corporate headquarters and plant, Blue M Electric Company, Blue Island, Illinois. All manufacturing and testing is conducted here. Recent additions have brought the total area under roof to approximately 350,000 square feet.



30,000 square foot Blue M Equipment sales/service facility at El Monte, California, left. An extensive inventory facilitates delivery and service in the far west. Above, eastern counterpart to El Monte is this new 16,000 square foot sales/service center at Framingham, Massachusetts, which serves the entire New England area directly.

a reliable source of custom-engineered products for exotic applications

facture of "standard" ovens, baths, furnaces and environmental equipment. Not only is this an additional assurance of quality and reliability, but this experience also enables important economies to be effected which keeps the cost of even the most exotic equipment to a minimum. Some of the design and manufacturing facilities making this possible are shown on the following pages.

The products in this catalog are presented in an application-solution format because each unit has been developed to solve certain production or testing problems. However, the problem in each case has necessarily been stated in broad terms to cover the basic purpose of the unit in question. A review of any unit—its design, construction, and operating characteristics—will quickly reveal an inherent versatility which enables it to be used in a variety of ways in addition to its prime function. Thus, though a product may be purchased on the basis of its ability to do a specific job, it can very probably double in another capacity. And in the case of a relatively short-term specialized contract, where a particular kind of equipment is needed, the same unit can be utilized for more general work later on—a definite

advantage from a capital expenditure standpoint. In fact, there are instances where custom-engineered Blue M units which enabled companies to obtain contracts in the first place are still performing other important testing/production jobs long after the initial contract has expired.

We emphasize that the units in this catalog are only examples of the design/manufacturing ability Blue M places at the disposal of industry. They are, in fact, the more common examples. There are many, many others of more specialized application which could be included but have not been because they are too specialized to have general interest. Some of them are pictured in each section.

If the equipment shown in this catalog suggests how Blue M can be of service to you, please contact your nearest Blue M Equipment office or write us direct outlining your basic requirements. Our staff of temperature controlled equipment experts will very probably be able to suggest a solution to your particular problem—whether you need one unit or dozens.

HISTORICAL HIGHLIGHTS

1946—Blue M founded as Modern Electric Laboratory in Chicago. Product line consisted of four units, and facilities of 2000 square feet.

1950—Occupied larger facilities in Chicago, became an Illinois corporation, and changed name to Blue M Electric Company.

1954—Moved to present Blue Island location. Plant occupied 21,600 square feet. Introduced MAGNI-WHIRL Baths and VAPOR-TEMP Humidity Chambers.

1960—POWER-O-MATIC 60 Saturable Reactor Proportioning Control introduced. This unique, patented control exemplifies Blue M's continuing program of research and product improvement.

1960—Blue M Engineering (now Blue M Equipment) established as separate division to provide technical sales and service help with custom-engineered equipment.

1963—Large plant addition completed. Coupled with two earlier expansions, brings plant size to 104,000 square feet.

1964—Blue M International formed as division to handle demand for Blue M products outside U.S.A.

1965—Concentrated program of product development in cryogenic equipment and Scientific and Laboratory equipment begun.

1966—Headquarters plant addition brings area under roof to over 208,000 square feet.

1966—New line of refrigerated chambers introduced, and is enthusiastically received.

1967—Patented POWER-O-MATIC 70 Solid-State Proportioning Control introduced on dozens of Blue M chambers.

1968—Broadening of product lines includes introduction of new Thermal Cycling and Shock Test Chambers.

1969—POWER-O-MATIC 75 and POWER-O-MATIC 80 Solid-State Control Systems developed and introduced on selective units requiring special programming and higher temperatures.

1970—Enlarged engineering, sales and office facilities at Blue Island brings total area under roof to about 250,000 square feet.

1971—Blue M celebrates 25th Anniversary.

1972—Blue M introduces FRICTION-AIRE™, the revolutionary electric ovens with no heating elements. Immediately acclaimed "one of the most significant technical products of the year."

1973—New solid-state instrumentation and built-in overtemperature protection on practically all models greatly improves high temperature oven and furnace line.

1975—New addition brings total plant area at Blue Island under roof to 350,000 square feet.

1976—Blue M celebrates 30th Anniversary

DESIGN/ ENGINEERING

The built-in reliability of all Blue M products begins right at the design stage. Careful engineering assures optimum performance and long-life at competitive cost. Blue M units are also subjected to continued study and review under actual operating conditions. This often suggests modifications and improvements which are incorporated into new designs . . . resulting in a constantly modernized product line. As you read this catalog, you'll find many new products being introduced here for the first time. This constant program of product development continues Blue M's leadership in the fields we serve.



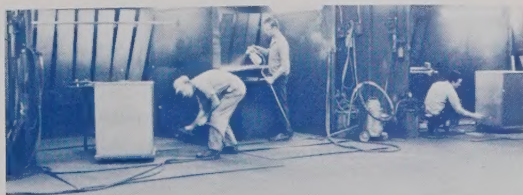
Fully equipped research laboratory where exhaustive analysis—including prototype testing—of new designs is conducted before equipment is released for production.



FABRICATING

Blue M uses the latest fabricating machinery and methods for various shearing, forming, punching, notching and other operations. Special gauges, fixtures and templates insure repetitive tolerances. All stages of manufacture are closely controlled to assure adherence to the tightest production—and delivery-schedules. Blue M is qualified and thoroughly experienced in the fabrication of cold rolled steel, stainless steel, copper, brass, aluminum, etc. We pride ourselves in being uniquely capable in the fabrication of stainless steels of all types.

The latest techniques in spot, arc, gas and heli-arc welding contribute much to the rugged durability of every Blue M product. New painting/baking facility, below, applies attractive long-lasting baked-on finishes in various attractive colors which complement any laboratory or production department. Carefully trained mechanics, right, perform a variety of delicate operations with practiced skill.



CONTROL ASSEMBLY

Control assembly requires special ability, care and attention. The department devoted to this exacting work employs only highly trained personnel working under ideal conditions. Here are assembled, inspected and thoroughly tested the patented POWER-O-MATIC 60® Control and other exclusive Blue M control systems. Special panels, components and compartments facilitate production—make a major contribution to Blue M reliability in the field.

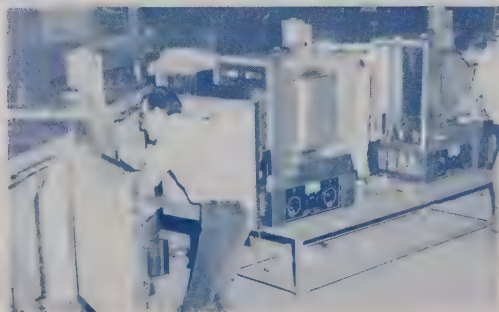


Above, modern wave soldering is utilized in the manufacture of the patented POWER-O-MATIC 70® Solid-State Proportioning Control System. After final assembly, every control is tested individually by the most sophisticated electronic instrumentation to detect any possible imperfections. Right, and left, other views of control assembly. All controls are subjected to rigid testing to insure proper operation in service.



FINAL ASSEMBLY

Although Blue M products are noted for their reliability, modern production planning enables many of them to be manufactured in volume quantities as these photos show. No-waste, production line manufacture speeds assembly—helps Blue M provide a better unit at a competitive price.

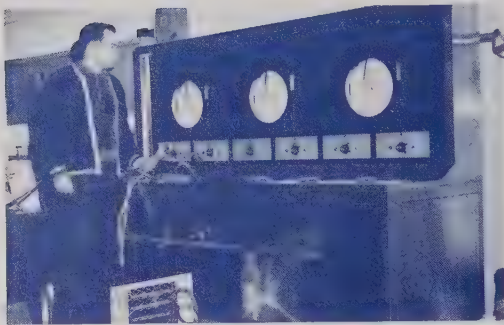


Above, A number of temperature/humidity chambers near completion. Right above, Water baths on the assembly line. Below, finishing touches are added to an oven.

SHIPPING, DOMESTIC OR EXPORT

Every Blue M unit is carefully packaged or crated for shipment. Most units are packed in cartons especially designed for them. This extra care in the last step of unit processing makes doubly sure that Blue M equipment arrives at its destination safely—ready to deliver all the efficiency and reliability designed into it at the factory. Export packing and crating is in accordance with the best recommended procedures.





QUALITY CONTROL

Every step in the manufacture of every Blue M unit is carefully supervised to assure the uncompromised quality of the finished product. This extends to the selection of raw materials and to any purchased components needed. By the time the unit is completed, it has been checked and re-checked to make sure it will withstand testing on the typical facilities shown here: top, facility for evacuation and charging of all Blue M refrigeration equipment. Capable of handling up to six separate units at once, it assures clean, dry refrigeration systems which can mean years of additional trouble-free operation; left, specially designed unit for individually testing refrigeration equipment after final assembly; center, special apparatus for testing 50 cycle units; right, ovens undergoing strip chart calibration test.



Many standard Blue M units are carried in stock, and are often shipped the same day an order for them is received. Delivery on modified standard equipment is also prompt since Blue M maintains an extensive inventory of accessories. Besides a reputation for reliable equipment, Blue M has long been recognized as providing the fastest delivery in the industry.

INVENTORY



Specially trained personnel work with the latest high speed data processing equipment to insure that every order is handled quickly and efficiently. Modern facilities such as these typify the progressive methods in operation throughout the company.



SERVICE

All Blue M equipment has been engineered to give long, virtually maintenance free service. Many units have been designed to operate unfailingly for decades! Any equipment, however, regardless of how well constructed may eventually require attention—parts, components, professional maintenance. Blue M maintains a complete line of spare parts and accessories in stock, ready for overnight shipment. When required, trained Blue M technicians are available to make on-site calls to place your equipment in service quickly, efficiently and economically. Your downtime is slashed to an absolute minimum . . . your testing/processing procedures are never seriously delayed.

Blue M engineers are available at any time for consultation in helping select the exact unit which best suits your requirements . . . and Blue M stands behind that unit with parts and service to keep it operating as specified. It's an unbeatable combination that guarantees complete satisfaction.

Shown here is our product display room where interested groups or individuals can see representative Blue M units operating, and study their many design and construction features in detail. We welcome the opportunity of having you visit us at any time.



HOW TO USE THIS CATALOG

There are four basic kinds of Blue M temperature controlled equipment in this catalog: Environmental Chambers—Temperature/Humidity, Refrigerated, Thermal Shock Test; Ovens; Baths; and Furnaces. A section is devoted to each of them, with an additional section describing a variety of accessories at the back.

The units are arranged within their respective sections according to the classifications described below: Standard; Special; and Custom. It thus becomes a simple matter to find just the unit you need—or the kind of unit Blue M can engineer for you.

ONCE AND FOR ALL . . . BLUE M REMOVES THE WORRY OF SELECTING THE PROPER EQUIPMENT FOR THE JOB

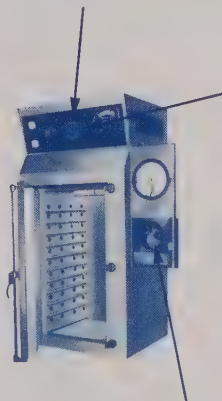
1. STANDARD UNITS

Designed for one or more jobs or functions, but versatile enough to be used for a variety of additional test/processing work. Generally identified with a photograph—as exemplified by the oven at right.

Blue M Standard units are available with a variety of accessories which easily and economically adapt them for specialized applications. On Batch Ovens, these accessories include such special instrumentation as automatic program timers and indicating pyrometers as well as rear doors, glass observation panels, lead-in ports and other physical modifications. Many of these accessories are shown in the accessory section beginning on page 178 of this catalog.

BLUE M INDUSTRIAL BATCH OVEN

Equipped with POWER-O-MATIC 60® Saturable Reactor Proportioning Control System for critical service
Described on Page 82 (large sizes)
Described on Page 80 (small sizes)



Economy Batch Oven equipped with Blue M Microtol Control for less exacting applications
Described on Page 92

Reactor-controlled oven equipped with programmer-controller and separate monitoring recorder
Described on Page 84

2. SPECIAL UNITS

These are units designed to perform specific jobs or to meet definite requirements. They are not intended for broad usage and cannot be modified extensively, but represent sound, practical solutions to difficult test/processing problems.

3. CUSTOM UNITS

A unique Blue M solution to a specific customer requirement. While generally one-of-a-kind units, they are often re-ordered after their efficiency has been verified in service. These examples of Blue M's ability to engineer to suit are presented here only to indicate our capabilities. They should not be taken as the limits of our abilities—but only as a measure of them. We suggest that if you have a special problem that you look at these units carefully. They may very well suggest how Blue M's skill and experience can be of service to you.

DOUBLE-CHECK OUR TERMINOLOGY AND WHAT IT MEANS TO YOU

Specific operating data is included on every unit in this catalog. A check of this information will tell the potential user exactly what he can expect in the way of performance once any given piece of equipment is placed in service.

For any such information to be meaningful, however, it must be defined and then the method whereby it was obtained shown. Anyone can make unsubstantiated claims, or quote performance figures obtained under unusual or ideal test conditions which have little or no chance of being consistently duplicated under actual operating conditions. Only when the basic test parameters used by different manufacturers correspond will the results stand fair comparison.

We are proud of the performance of all Blue M equipment. And for the record—to be critically compared with the method used by any other manufacturer—the following criteria serve as the basis for all performance data shown in this catalog. Comparison of this information with equivalent competitive equipment will reveal that, unit for unit, Blue M products far surpass any other on the market.

CONTROL REPEATABILITY:

The ability of a controller to duplicate a previously set temperature.

METHOD: in a +400°C. oven, for example, an accurate temperature check is made every 50°, starting at +100°C. and running up to the maximum. These temperatures are recorded. The same procedure is followed the next day, and the results of both series of tests are compared.

Blue M POWER-O-MATIC 60 Saturable Reactor Proportioning Control duplicates temperatures to $\pm 1/3$ of 1% of scale range.

TEMPERATURE UNIFORMITY:

The amount of continuity between the set temperature and the actual temperature reached at different points inside the working chamber.

METHOD: 20 ga. thermocouples are placed at nine positions in working chamber—one in each corner, 2"–3" from side walls and one in the center of the chamber. Thermocouple output is then read out on a potentiometer which has accuracy of $\pm 1/5$ of 1% of scale range.

CONTROL DRIFT:

The amount of deviation from set temperature once equilibrium has been established in controlled medium. Drift from control point is usually due to a change in line voltage, ambient temperature, or both. Improper installation of the control sensing device (thermocouple, sensing bulb, etc.) limits the ability of the controller to respond effectively to minute temperature changes.

METHOD: a 20 ga. thermocouple is placed in the center of the working chamber. The unit is then run at one temperature continuously for 24 hours.

RECOVERY TIME.

The length of time required for the temperature inside the working chamber to return to operating temperature after the door has been opened for a prescribed period.

METHOD: a 20 ga. thermocouple is positioned in center of working chamber, and unit is allowed to stabilize at working temperature. Door is then opened for a specified time. The time it takes for the working chamber temperature to again reach operating temperature is recorded on potentiometer strip chart recorder.

BLUE M EQUIPMENT

A SALES AND SERVICE BRANCH OF
BLUE M EQUIPMENT COMPANY
Corporate Headquarters: Blue Island, Illinois 60406

Arizona, Scottsdale 85251
California, El Monte 91731
California, Sunnyvale 94086
Florida, Orlando 32789
Georgia, Atlanta 30341

Illinois, Blue Island 60406
Massachusetts, Framingham 01701
Michigan, Allen Park 48101
New York, Elmsford 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

FINALLY, CONTACT BLUE M, BECAUSE . . .

**you can't buy any Blue M unit until
we're sure it will do the job you want**

Even though you've selected a unit that looks good to you . . . checked that its performance seems to meet your needs . . . even then you can't buy it. Simply because we won't sell you any chamber in this catalog until we're satisfied that it will, indeed, meet the requirements of the application you have in mind. And that holds true whether you're interested in one chamber costing a few hundred dollars or several costing many thousands of dollars each.

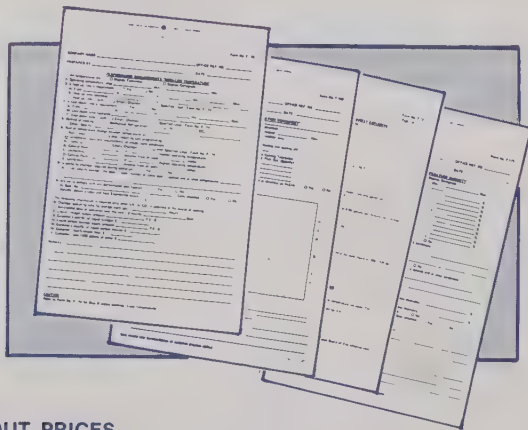
Our reasoning behind this principle is clear. All Blue M chambers have years of developmental and field-service experience behind them. They are constantly being modified and improved based on this experience until they are, truly, the finest units of their kind available anywhere. They work well.

So does a Rolls-Royce. But no one in his right mind would think of putting a stock Rolls into the Indy 500. As fine a machine as it is, it couldn't be expected to compete favorably. Used in the manner for which it was designed, it will last almost indefinitely. Misapply it, and it will almost certainly fail.

And so it is with every Blue M chamber in this catalog. Applied properly, it will give long, reliable service—the kind of service you have a right to expect from fine equipment. Misapply it, and you can expect operational results not commensurate with the inherent capabilities of the unit.

Accordingly, before you buy any Blue M chamber, your application is studied by trained Blue M field personnel. They are qualified to recommend the kind of unit that fits your needs best. (And don't be surprised if they suggest a less exotic and more economical unit than you anticipated. People often think their particular application takes more unit than is really necessary.) After consultation with you, the detailed Application Survey shown below is completed, and forwarded for approval by Blue M's Engineering Department. Only after this final OK will your order be accepted.

We urge you to keep this application service in mind. It and the unique Warranty at the right are your final assurance of satisfaction with your Blue M equipment . . . and our best insurance that you'll come back to us in the future.



A WORD ABOUT PRICES

As you look through this catalog, you will note that we have not included unit prices. These have been omitted deliberately. As we have said, every unit in this catalog—even the Standard ones—is sold on an individual basis only after we have studied the application for which it is intended and verified that it will meet customer requirements. Thus, because every Blue M product is in effect "engineered to the job"—and guaranteed to perform it—it is more practical to supply a firm price with the quotation once the application and unit have been matched.

However, Blue M prices are competitive. In fact, they are often well below those available from others. And this holds true even though we insist on assuring ourselves and the customer that the unit will perform as required before it is sold.

GENERAL BLUE M

All Blue M equipment is warranted against defective material and workmanship. This warranty varies with the type of equipment sold, but in no instance is it less than one year from date of shipment. All replacement parts will be invoiced and credit issued upon receipt of defective part.

1. Control Systems Manufactured By Blue M: Defective parts will be replaced without charge, for installation by user, including normal transportation charges within continental United States and Canada, as follows:

	Fully Proportional	
POWER-O-MATIC 60:		5 Years
POWER-O-MATIC 70:		2 Years
POWER-O-MATIC 80:		2 Years
POWER-O-MATIC 90:		5 Years
	On/Off Cycling	
MICROTROL		1 Year
DUAL MICROTROL		1 Year

2. Heating Elements. Are warranted from one year up to five years depending on equipment. However, furnace elements and thermocouples, although designed specially for furnace service and built of the finest materials, cannot be guaranteed because it is impossible to predict the temperature or severity of service to which they will be subjected. (See product listing.)

3. Commercial Instrumentation Manufactured By Others: Covered by separate manufacturer warranty, generally one year. Contact Blue M for instructions on obtaining service.

4. Blower Motors and Refrigeration Compressors: Covered by separate manufacturer warranty, generally one year. Contact Blue M for instructions on obtaining service.

5. All Other Components: Including switches, pilot lights, relays, transformers, Ready-Read Temperature Indicators, hardware and gaskets will be replaced without charge for installation by user up to one year from date of shipment.

Our warranty does not cover damage or failure caused by abuse, misuse, abnormal usage, faulty installation, improper maintenance or any repairs other than those provided by authorized Blue M Service Personnel.

The foregoing warranties are in lieu of all other warranties expressed or implied, including the guarantees of merchantability or fitness and there are no obligations or liabilities on the part of Blue M Electric Company for consequential damages arising out of or in conjunction with the use or performance of the product or other indirect damages with respect to loss of use revenues or profit.

There are no warranties which extend beyond the description on the face hereof. The foregoing states our entire liability in respect to our equipment, except such as authorized executive of Blue M Electric Company may otherwise agree in writing.

The above is a general statement of warranty. Some Blue M Products are covered under individual service and replacement policies. Details on request.

Blue M Maintenance Agreement Program. Blue M has available a flexible Maintenance Agreement Program which covers the periodic inspection and maintenance of our equipment at the user's location.

This economical program is available from a number of Blue M offices located strategically throughout the United States. Please contact the factory for complete information.

For warranties on individual Blue M products please refer to the following page.

PARTS WARRANTY AND REPLACEMENT SERVICE PROGRAM

TEMPERATURE CONTROLLED CABINETS

POWER-O-MATIC 60 OVENS

Control System	5 year
Blower Motor (if used)	1 year
Heating Element	5 year
Other Components	1 year

POWER-O-MATIC 70 OVENS

Control System	2 year
Blower Motor (if used)	1 year
Heating Element	2 year
Other Components	1 year

POWER-O-MATIC 80 OVENS

Control System	2 year
Blower Motor (if used)	1 year
Heating Element	2 year
Other Components	1 year

POWER-O-MATIC 90 OVENS

Control System	5 year
Blower Motor	1 year
Other Components	1 year

OVENS/MECHANICAL CONVECTION

Control System (commercial instrumentation)	1 year
Blower Motor	1 year
Heating Element	2 year
Other Components	1 year

BATHS

POWER-O-MATIC 60 BATHS

Control System	5 year
Heating System	1 year
Other Components	1 year

POWER-O-MATIC 70 BATHS

Control System	2 year
Heating Element	1 year
Other Components	1 year

OTHER BATHS

Control System	1 year
Heating Element	1 year
Other Components	1 year

PORTABLE COOLING UNITS

Control System	1 year
Refrigeration System	1 year

ENVIRONMENTAL-TEMPERATURE/HUMIDITY

POWER-O-MATIC 60 ENVIRONMENTAL UNITS

Control System	*5 year
Heating Element	1 year
Other Components	1 year

POWER-O-MATIC 70 ENVIRONMENTAL UNITS

Control System	2 year
Heating Element	1 year
Other Components	1 year

ENVIRONMENTAL CHAMBERS (LN₂ OR CO₂)

Control System (commercial instrumentation)	1 year
Blower/Motor	1 year
Heating Element	2 year
Other Components	1 year

FURNACES

POWER-O-MATIC 80 FURNACES

Control System	2 year
Heating Elements/Thermocouples	Not Warranted
Other Components	1 year

STABIL-GLOW/LAB-HEAT/RAD-O-GLOW FURNACES

Control System	1 year
Heating Elements/Thermocouples	Not Warranted
Other Components	1 year

Please refer to specific unit warranties for individual and itemized component warranty.

*Due to corrosion and contaminate problems beyond our control, sensing elements of the POWER-O-MATIC 60 Control System employed in Environmental equipment are warrantied for two years. All other system parts are warrantied five years.



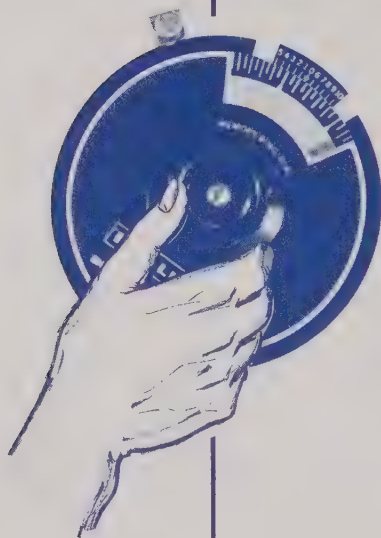
BLUE M EQUIPMENT

A SALES AND SERVICE BRANCH OF
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California, El Monte 91731
California, Sunnyvale 94086
Florida, Orlando 32789
Georgia, Atlanta 30341

Illinois, Blue Island 60406
Massachusetts, Framingham 01701
Michigan, Allen Park 48101
New York, Elmsford 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108



THE ONLY COMPANY MAKING TEMPERATURE CONTROLLED EQUIPMENT AND THE CONTROLS TO REGULATE IT

That's well worth remembering because of its importance to you as a specifier of constant temperature controlled equipment. If you think about it a minute, you'll see why . . .

It's no secret that many companies make such equipment. We think we make the best, and we think an examination of the construction details of any of the hundreds in this catalog will verify it. But even the best built chamber (or car, or radio, or anything that must operate in order to perform a function) isn't much good if it doesn't offer the performance required to do its job properly. And since the prime purpose of any such chamber is to serve as a reliable means to duplicate a desired environment (heat, cold, moisture, etc.), the key to its performance lies in the method of regulating temperature. The controls, in short.

Blue M believes the best performance is achieved only when the control and chamber are perfectly matched. Like a car. A Buick will operate if you put a Ford engine in it. Or a Dodge engine. But the Buick will probably operate best with a Buick engine. Similarly with chambers. You can't build one, slap just any available instrumentation on it, and expect peak performance.

There are exceptions, of course, where practicality enters the picture. In budget-type gravity ovens, for example, requirements aren't critical and good performance is adequate. It's senseless to use hundreds of dollars of instrumentation with an \$80.00 shell. Not only would such equipment be priced beyond the market, but it might well offer far better performance than ever needed. It might provide $\pm 0.1^\circ\text{C}$. control when $\pm 5.0^\circ\text{C}$. would do the job. This would be analogous to delivering milk from a Rolls-Royce.

Accordingly, Blue M offers the test/processing field equipment both quality-built and matched exactly to the needs of the marketplace. We build equipment priced for run-of-the-mill needs and products that meet or exceed even the most stringent performance demands. They meet these requirements and remain competitively priced because they feature Blue M's own control systems which complement the cabinets exactly.

These systems are described on the following pages. Please review this material carefully. It may well suggest why Blue M is the leading manufacturer of fine temperature controlled equipment. And why it is the only such equipment you should buy.

set them . . . and forget them!

POWER-O-MATIC 60[®]
PATENTED

POWER-O-MATIC 70[®]
PATENTED

POWER-O-MATIC 80[™]
PATENTED

POWER-O-MATIC 90[™]
PATENTED

Used exclusively on Blue M's
revolutionary FRICTION-AIRE[™]
chambers—the ovens with
no heating elements. See pages 72-79.

EQUIPMENT COVERED BY
OUR
EXCLUSIVE

PARTS
WARRANTY
and
REPLACEMENT
SERVICE
PROGRAM



BLUE M

POWER-O-MATIC 60[®]

PATENTED

SATURABLE REACTOR PROPORTIONING CONTROL SYSTEM

HERE'S WHY WE USE IT—AND WHY YOU'LL WANT TO!

The majority of units in this catalog feature this exclusive Blue M development. We use it so extensively not just because it is a patented Blue M device, but because we sincerely believe it is the finest, most reliable control system on the market today. We've tried and tested the others . . . compared them all against POWER-O-MATIC 60 . . . and there's not one that will surpass it in performance. Most can't even come close. Even complex potentiometric systems (the one's that cost hundreds of dollars) can't beat the POWER-O-MATIC 60.

If this sounds like we're boasting—we are! And you'll see why after you read the facts on this remarkable system below and see proof of its performance on later pages. If you keep these facts in mind as you see the equipment offered with this control system, you'll understand why Blue M has become the acknowledged leader in the controlled temperature equipment field.

HERE ARE A FEW FACTS TO KEEP IN MIND ABOUT POWER-O-MATIC 60 AS YOU READ THIS CATALOG

INFINITELY PROPORTIONAL: POWER-O-MATIC 60 is a truly proportional, straight-line control. Stepless, switchless, and fully automatic, it keeps working chamber conditions constant and repetitive throughout the unit's range.

UNHEARD OF SIMPLICITY: POWER-O-MATIC 60 has a minimum number of components. So few, in fact, that failure is almost impossible . . . maintenance practically nil. There are no moving parts . . . no tubes, photo cells, timers, relays, switches, amplifiers . . . no auxiliary devices to wear, burn or replace. POWER-O-MATIC 60 is so simple that it is designed to operate under normal conditions for 10 to 20 years . . . will probably outlive the chamber it controls! The block form electrical diagram below shows just how simple this system is.

NO FIX . . . NO FUSS . . . NO FIDDLIN' AROUND

You can be sure that any test or process started in a POWER-O-MATIC 60 controlled chamber will finish in spec—whether the run takes minutes or weeks! There are no delicate adjustments to be constantly made, no scurrying around looking for tools and spare parts, no perpetual checks and re-checks, no worry. Just set the control and turn on the unit. POWER-O-MATIC 60 does all the

work . . . you don't even have to watch.

RELIABILITY: THOUSANDS OF YEARS OF IT

POWER-O-MATIC 60 has proven itself in exacting applications of all descriptions for years. In laboratory, pilot plant, research and production work . . . for long-term testing and short-time processing . . . to tough MIL specs and sometimes even tougher industrial specs—POWER-O-MATIC 60 chambers have met every challenge of reliability. Thousands of them. To the best of our knowledge, every POWER-O-MATIC 60 control system ever built—is still operating . . . is still maintaining the close control tolerances for which it was designed.

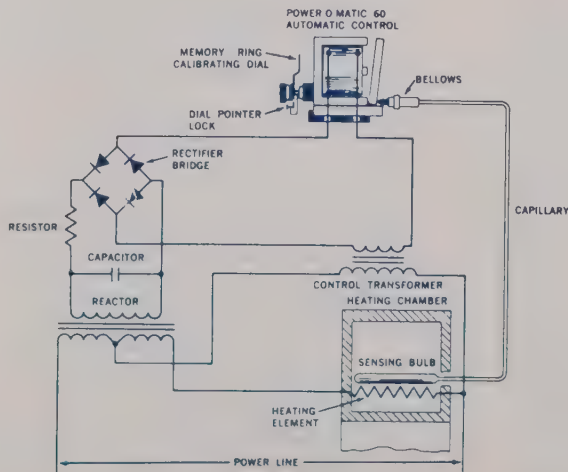
Incidentally, POWER-O-MATIC 60 units under test have been operating continuously since June, 1960. This is equivalent to several decades of normal operation, yet there has never been even a hint of failure. This is why POWER-O-MATIC 60 Ovens, for example, carry our unique 5-year warranty/guarantee . . . why we can say POWER-O-MATIC 60 will probably outlast the equipment it controls!

UNBEATABLE PERFORMANCE AND ECONOMY

POWER-O-MATIC 60 assures reliable performance that can't be touched even by equipment costing hundreds of dollars more. POWER-O-MATIC 60 offers actual repeatability of $\pm 0.5^\circ\text{C}$.—the same as costly (and complicated) potentiometer systems! Yet these units are competitively priced with equipment with outmoded on-off controls.

Operating characteristics are included for every unit described in this catalog. Look closely at the figures quoted. Remember: these are actual figures—a true representation of chamber performance obtained from typical production run units as they are tested before shipment. We wager that unit-for-unit, dollar-for-dollar, there is no comparable equipment available from any source that can match them.

Described on the following pages are a few additional features which contribute to the overall safety, efficiency and performance of POWER-O-MATIC 60 units. Add these to all the other advantages—reliability, accuracy, simplicity, economy—and remember they're not idle claims but demonstrable facts. You'll quickly understand why users unanimously agree that POWER-O-MATIC 60 is far and away the finest control system available today.



UNIQUE WARRANTY

All equipment in this catalog is covered by Blue M's exclusive Warranty. This includes the individual units themselves as well as—in the case of the POWER-O-MATIC 60 Saturable Reactor Proportioning Control System particularly—the control instrumentation. Details of this Warranty are provided on pages 12 and 13. We urge you to review this material carefully. It is your final assurance of complete satisfaction with the Blue M chamber of your choice.

BLUE M EQUIPMENT

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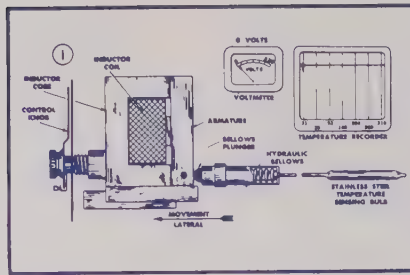
Arizona, Scottsdale 85251
California, El Monte 91731
California, Sunnyvale 94086
Florida, Orlando 32789
Georgia, Atlanta 30341

Illinois, Blue Island 60406
Massachusetts, Framingham 01701
Michigan, Allen Park 48101
New York, Elmsford 10523
New York, Syracuse 13206

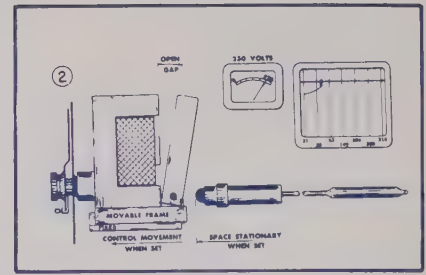
North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

HERE'S
HOW

POWER-O-MATIC 60
PATENTED
OPERATES



STEP No. 1: Control setting at ambient temperature. Armature gap is normally closed with bellows plunger non-extended.



STEP No. 2: Control setting at +260°C. Note lateral movement of inductor coil and inductor core with resultant stationary space between bellows plunger and armature. Voltmeter reading at full voltage and remains thus until plunger is extended.

AND THESE EXCLUSIVE FEATURES MAKE **POWER-O-MATIC 60** SAFER,
PATENTED

Max-Set^(TM) OVERTEMPERATURE PROTECTION
PROBABLY THE MOST SOPHISTICATED BUILT-IN SAFEGUARD EVER DEVELOPED!

Exclusive Blue M design—providing positive protection of valuable workloads and equipment—offers features, operational efficiency, and simplicity never before available.

MAX-SET eliminates nuisance tripping. If OTP should be activated due to a significant line voltage surge or sudden shock, for example, an alarm sounds to alert the operator. This alarm stops once conditions return to normal, the OTP resets automatically, and the chamber continues to operate.

However, should a true overtemperature condition arise—due to component failure, combustion within the chamber, etc.—the alarm will sound as MAX-SET shuts down the chamber. As conditions within the chamber reach a temperature below OTP set point, the alarm stops and the chamber is once again activated. If the problem has not been solved, temperature will rise and trip the OTP. Again the alarm will sound and MAX-SET will shut down the unit. This cycle repeats several times until MAX-SET automatically shuts down the chamber and silences the alarm permanently. A red light then signals the operator that the chamber is in a true failed condition and that remedial steps must be taken. After the cause of the failure has been determined and corrected, MAX-SET must be re-activated by means of a manual switch.

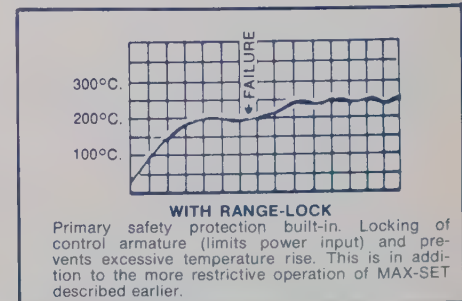
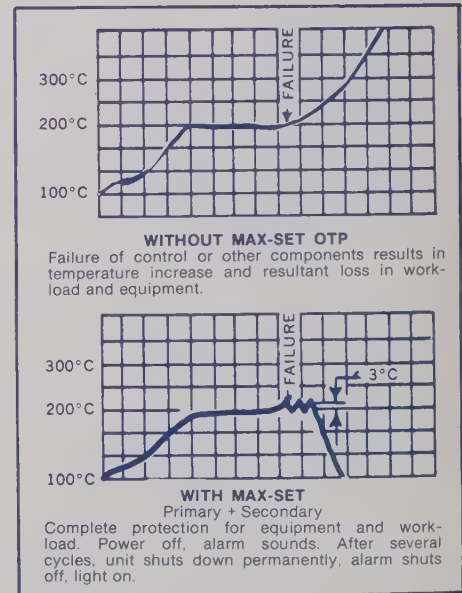
MAX-SET features full scale setability—can be set to operate at any temperature within the chamber's range. And OTP set point is easily established and quickly located—permitting overtemperature setting to be established very close to desired operating temperature and minimizing the chance of operator error.

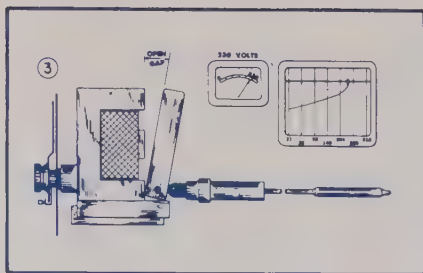
MAX-SET, as described here and with variations in conjunction with other instrumentation, is standard on many units in this catalog. It is also available separately for use on existing equipment as shown on page 181.

RANGE-LOCK

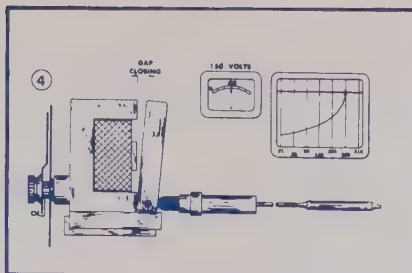
AN ADDED SAFETY FEATURE AT NO ADDED COST

It should be noted that units equipped with POWER-O-MATIC 60 Control also feature Range-Lock Overtemperature Protection. This device mechanically locks the control armature and prevents an excessive rise of the set temperature (limits power input) even if thermal system ruptures or if control knob is accidentally turned. Range-Lock's operation is illustrated in the chart at right. As indicated, it prevents temperature runaway but does allow a temperature rise of some significance. Built-in MAX-SET OTP system described above limits temperature rise much more severely—on the order of 3°C.

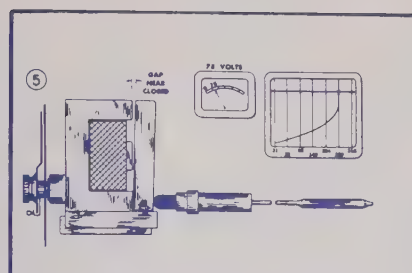




STEP No. 3: Hydraulic bellows expansion due to temperature rise causes bellows plunger to extend laterally to contact armature. FULL ELEMENT HEAT UTILIZED TO THIS POINT. Control action now within proportional band of 4% of scale range. In this illustrative case of +260°C. setting, temperature is +249°C. and voltage (wattage) will now begin to decrease. See next illustration.



STEP No. 4: Control action operating within proportional band. Powerful bellows plunger rapidly closes armature gap and temperature begins to stabilize. Extremely sensitive action provides proportional regulation of wattage and temperature. Note voltage decrease to 150 volts.



STEP No. 5—OVEN AT EQUILIBRIUM. Control operation stabilized at +260°C. and performance is TRUE STRAIGHT-LINE. Bellows plunger movement due to temperature increase or decrease (because of heat load changes) causes voltage (wattage) to automatically increase or decrease, correspondingly. Control stabilization is in a true static state, stepless and fully automatic.

EASIER AND MORE EFFICIENT TO USE THAN EVER

EXCLUSIVE DUAL SCALE

MEMORY RING®

TEMPERATURE CALIBRATING DIAL



MAKES PIN-POINT CALIBRATION OF ALL TEMPERATURES EASY!

All Blue M Control Systems feature this advanced development . . . makes them all easier to use and more accurate than ever. Blue M equipment is calibrated to commercially acceptable standards before shipment. The Memory Dial lets you zero-in on all temperatures, or those you use most, with laboratory exactness—and "remembers" every calibration factor for reproducibility. Simply write proper correction factor for any given temperature on the dial. Next time that temperature is required, correction factor automatically appears in the dial window. You get the exact temperature called for every time. New dual scale calibrated in both °C. and °F.—and designed to permit instant change from one to the other at will but with only one scale visible at a time to avoid confusion. Dial Pointer Lock secures your temperature setting . . . prevents inadvertent change of set temperature by accidental bumping or unauthorized personnel. Memory Ring is also an integral part of MAX-SET OTP and other Blue M overtemperature protection systems as well as the Blue M control systems on the following pages.

ELAPSED TIME METER

SERVES A VARIETY OF USEFUL FUNCTIONS TO SAVE YOU MONEY

The Elapsed Time Meter now standard on many units in this catalog provides information which can greatly improve operational efficiency while saving money. Its function, of course, is to show exactly how long the unit has actually operated. It is rated at 99,999.9 hours. Properly used, these data can serve a number of uses.

For example, the Elapsed Time Meter can show how long a given test or process has run. For prolonged life-test work, particularly, the Meter can serve as a timer since it is accurate to 1/10 of an hour.

Many companies have regular maintenance programs based on the calendar rather than on equipment usage. Intermittently used equipment may be on a 30-day schedule with maintenance dutifully carried out, even though the equipment may not have been used at all during that particular period. By showing just how much time the equipment has been used, the Meter can avoid unnecessary maintenance and expense. Verification of actual operating time can also be used to compute monthly or yearly equipment costs.

The purchase of capital equipment is often predicated, in part, on the amount of time it will be utilized by a given facility or department. The Meter "reports" and verifies precisely how much time the equipment is really used—and serves to indicate whether there is a need for like equipment in the future, how much such equipment is needed, and even when it should be purchased.

Finally, it is common practice for most manufacturers to make extraordinary performance promises when new equipment is being evaluated before purchase. These promises are often conveniently forgotten once the equipment is installed and problems develop. The Meter not only proves our performance commitments, but its very presence on the Blue M unit you buy verifies our faith in our equipment. It wouldn't be there if we had something to hide. The Elapsed Time Meter is one more assurance of your complete satisfaction with the Blue M equipment you select.

STEADY-TEMP AMBIENT TEMPERATURE COMPENSATION

The design of the POWER-O-MATIC 60 Control includes inherent protection against the effects of normal line voltage or ambient temperature fluctuations which often seriously affect the performance of other controls, make them erratic and even fail. While this built-in safeguard is adequate for the vast majority of applications, there are some unusual applications (for example, in extremely close tolerance work where the unit is exposed to abnormal ambient conditions throughout the day and night of seasonal operation) that warrant the inclusion of an extra compensating feature.

Blue M's exclusive Steady-Temp Ambient Temperature Compensation provides a simple, direct, positive check against abnormal conditions. It compensates for any and all such changes automatically, and assures that the set temperature will be constantly maintained within the fine limits of the POWER-O-MATIC 60 Control itself.

Steady-Temp Ambient Temperature Compensation is included as standard on many POWER-O-MATIC 60 controlled units (refer to specifications) for extremely close tolerance work, and is optionally available on all Blue M reactor-controlled units. Contact factory for full information and prices.

BLUE M EQUIPMENT

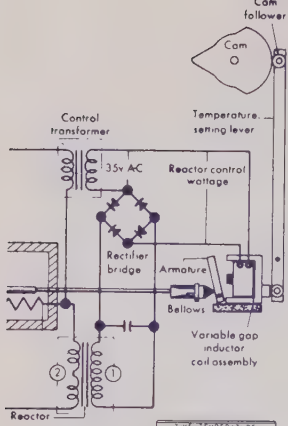
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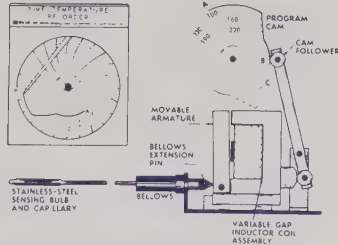


ADD A CAM AND CAM FOLLOWER FOR A PROGRAMMING CAPABILITY YOU ALMOST HAVE TO SEE TO BELIEVE!

POWER-O-MATIC 60
PATENTED

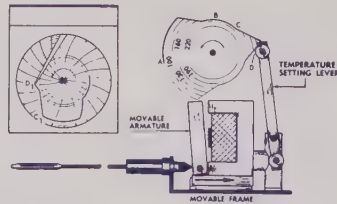
PROGRAMMER-CONTROLLER

HERE'S HOW THIS REMARKABLY ACCURATE SYSTEM WORKS

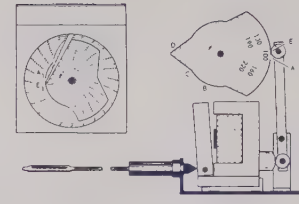


PROGRAM CYCLE OF UNIT

(1) Program started at point A on program cam has progressed to point B. Corresponding temperatures are shown at A1 and B1 on temperature record chart. Point C on cam is moving toward cam follower. When point C is reached, temperature will be reduced from high to low level.



(2) Cam has rotated beyond point C and is now at point D; temperature climbs to high conditions of programming. Note that positive feedback control bellows has extended to remain in contact with movable armature. Entire control assembly is moving to the right.



(3) Cam has rotated to point E. Program is nearly completed as indicated at E1 recorder chart.

When movable armature in above drawings is at maximum distance from variable gap inductor coil assembly, the voltage to heaters is at MAXIMUM input (approximately 90% of line voltage). Conversely, minimum distance is MINIMUM voltage (6% of line voltage). Any intermediate position provides an intermediate value (6%—90%).

Sensitive, stainless steel hydraulic bellows assemblies have liquid filled sensing bulbs which expand or contract as temperatures increase or decrease.

Attached bellows extension pin moves longitudinally increasing or decreasing air gap and subsequent voltage (wattage) to heaters. When wattage inputs are in balance with cabinet heat losses, a constant condition of stable equilibrium is attained.

Temperatures remain constant and any changes are a function of rotating Program Cam profile. As cam rotates, cam follower attached to inductor coil assembly moves longitudinally, changing conditions required. Simultaneously, bellows expands or contracts changing air gap opening to provide proper voltage in relation to conditions outlined.

BUILT BY BLUE M... MATCHED TO BLUE M EQUIPMENT FOR UNMATCHED TOTAL SYSTEM PERFORMANCE!

Keeping in mind the many outstanding advantages inherent in the POWER-O-MATIC 60 Control, it is easy to imagine the kind of superior performance that will result when this reactor system is modified for programming. And a modification to the basic control system is all it takes. As the drawings and explanation show, the simple addition of a cam and cam follower converts the system into a programmer-controller which has no peer. Identical sensing elements are employed for recording the precise results of the POWER-O-MATIC 60 Control.

Here are some facts about this unique system to consider:

EXACT PROGRAM DUPLICATION

POWER-O-MATIC 60 Programmer-Controller duplicates virtually any desired time/temperature cycle within the range of the equipment it controls. The only limitations are the accuracy of cam cutting and the heating and cooling rate of the unit. It holds a tolerance of $\pm\frac{1}{2}^{\circ}\text{C}$. during temperature transitions, and repeats stabilized conditions $\pm\frac{3}{4}^{\circ}\text{C}$.

EXACT PROGRAM REPETITION

POWER-O-MATIC 60 Programmer-Controller repeats any desired cycle—regardless of its complexity—over and over. It will never be off more than 3°C . at any point—even if the program runs for weeks on end.

UNEQUALLED PROGRAMMING FLEXIBILITY

POWER-O-MATIC 60 Programmer-Controller can meet an unlimited number of programming requirements. Most applications are simple; bringing a workload, for example, from $+50^{\circ}\text{C}$. up to $+300^{\circ}\text{C}$. in 70 minutes, holding for 180 minutes, and lowering down to $+118^{\circ}\text{C}$. over a seven-hour period. If yours is such a run-of-the-mill application, all well and good. But if you have something more exotic in mind, please consider this:

The inherent capabilities of the POWER-O-MATIC 60 Programmer-Controller can be modified and extended infinitely through the simple addition of timers to vary the cycle period. For example, a standard 30-day mechanism can be timed to be operating only 50% of the time. This extends the cycle time to 60 days. If it is regulated to operate only 25% of the time, the

cycle is extended to 120 days; 12½% of the time, 240 days—and so on. Thus a gradual decrease (or rise) of, say, 25°C. can be extended over a period of many months. If need be, the cycle can be repeated without interruption over and over—for years! (POWER-O-MATIC 60 is so reliable that it will operate continuously for years without care or attention!)

Conversely, a given cycle can be repeated over and over again every few minutes simply by adding the appropriate cam motor. Within the natural operating limitations of the chamber, your program can run for a few minutes or for many months. POWER-O-MATIC 60 will handle it with unmatched ease, dependability and reliability—regardless of cycle length.

The simple addition of a second appropriately cut cam can activate sequentially two or three micro-switches to perform multiple functions. In effect, this makes the system into an all-in-one temperature programmer and program timer that is perfectly and permanently synchronized. Such functions as timing compressors on and off, actuating exhaust dampers or blowers, energizing auxiliary controls, etc., may be performed at precise points in the program, and they will occur at exactly the same points every time the program is run.

In addition, a POWER-O-MATIC 60 Dual Programmer-Controller can simultaneously program a given cycle (or different ones) in two separate chambers. The second cam enables the temperature in two chambers to be regulated by the same system. Whether identical or completely different, the programs are synchronized exactly. This same dual system is used on Blue M Constant Temperature/Humidity Cabinets to provide the pinpoint regulation of temperature and humidity demanded by various MIL and industrial specs. These units are described in full in the Environmental Equipment section of this catalog.

TO CHANGE THE PROGRAM YOU JUST CHANGE THE CAM

It takes at most just three simple steps to switch from one program to any other within the chamber's range.



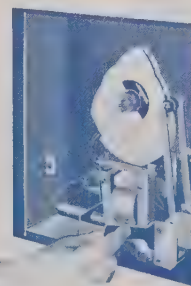
1. Unloosen locking screw and slip out old cam.

2. Slip on different pre-cut cam, lock in place, and position cam follower.



If, after running through a portion of the programming cycle, you find that calibration is necessary

3. Simply twist calibration nut slightly. There are no linkages or other components to adjust



The accuracy of the POWER-O-MATIC 60 Programmer-Controller is very largely dependent upon the accuracy with which the cams have been cut. The more accurate the cam, the more accurate the programmed cycle. If your cams have been cut exactly as required, it's possible that no calibration will be necessary when changing from one program to another. In any event, your own personnel can easily make the change—without costly service calls by the manufacturer.

SIMPLE PROGRAM CHANGE

To change your program, you just change the cam. Complicated recalibration and other procedures are not necessary. The photographs below show just how simple this is.

ATTENTION-FREE, IN-SPEC OPERATION

Competitive equipment approaching the performance capability of the POWER-O-MATIC 60 Programmer-Controller often requires constant operator attention and frequent service calls by the manufacturer. Not so with this unique Blue M system. It's easy to start-up in the first place, and once operating requires little or no attention or service. It must be deliberately tampered with before it will program out of spec!

MORE-THAN-COMPETITIVE PRICE

POWER-O-MATIC 60 Programmer-Controller prices are low—ridiculously low—for performance like this. A complete programming system—plus a typical Blue M chamber—often costs less than other programming systems of comparable performance alone!

UNSPECIALIZED "SPECIALS"

As the only company that designs and builds the chamber and the programming system, Blue M exercises complete control over their production . . . can quickly and economically tailor a programmed unit to any requirement. You may have already found that it takes weeks (if not months) to get the exact programmed unit you need from some manufacturers because they are "specials." It takes that long to modify their complex programming systems to handle unusual needs. With Blue M, modifications (if any are needed at all) are simple . . . your "special" (programmer and matched chamber) is ready to ship in a few days.

FOR PROOF THAT POWER-O-MATIC 60 PROGRAMMING IS EVERY BIT AS GOOD AS WE SAY IT IS, TURN PAGE . . .

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Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

TYPICAL EXAMPLES OF TEMPERATURE/HUMIDITY

TO MILITARY SPECIFICATIONS

Blue M Temperature/Humidity Cabinets have long been relied upon to accurately and reliably reproduce a variety of Military Specifications. These chambers were, in fact, initially developed specifically to meet the demand for such service.

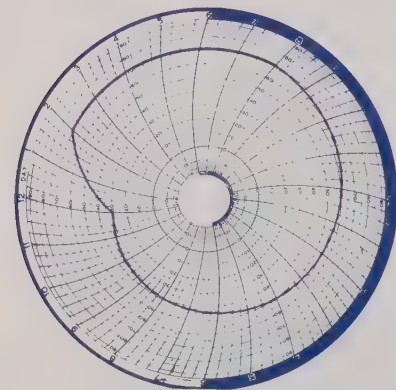
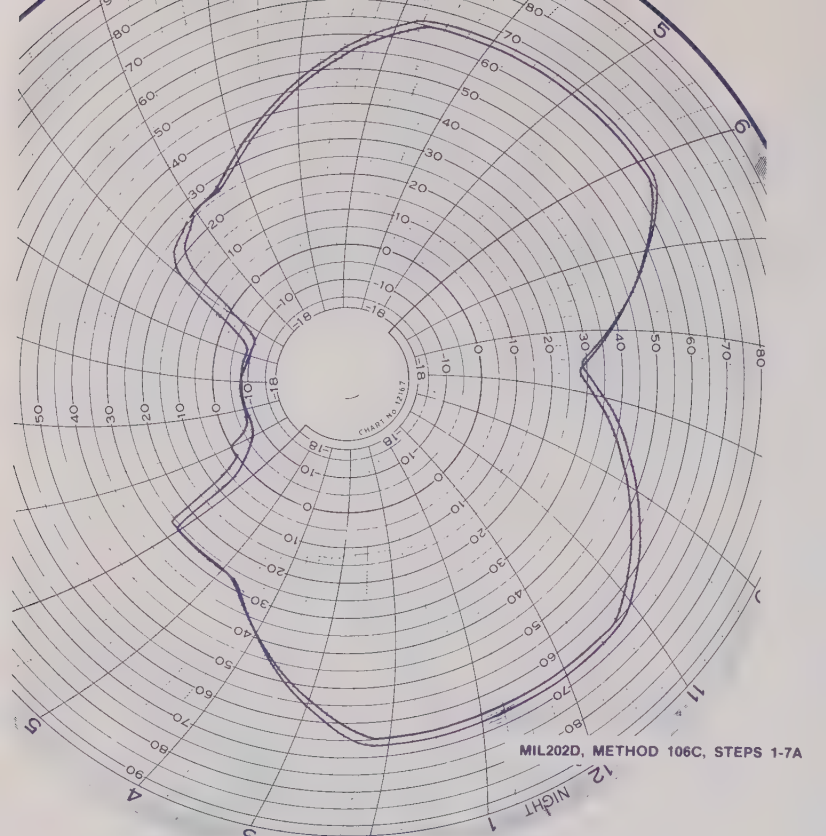
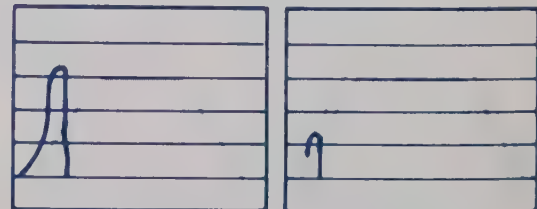
We've reproduced here a number of the more popular programmed Military cycles which are duplicated regularly in Blue M Full Range Constant Temperature/Humidity Cabinets. These are actual photographs of typical charts showing the remarkable accuracy of Blue M's cam-type POWER-O-MATIC 60 Programmer-Controller. These are the kinds of results users obtain day in and day out . . . the kind of results you can expect in similar applications.

Please remember that these are only the more popular programmed cycles available. In addition, we maintain an excellent reference library of other military specifications including environmental testing of all electronic and electrical components, wire, cable, photographic equipment, aircraft equipment and components to name just a few. We welcome the opportunity to discuss your application—and to demonstrate the chambers which can meet it as no other equipment can.

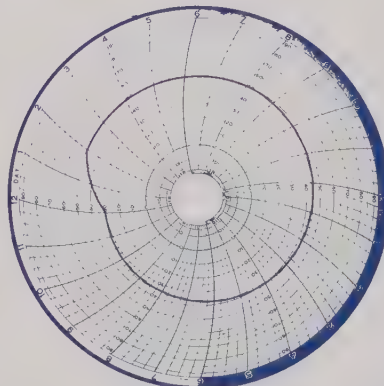
NOTE: The Blue M Cabinets capable of this performance are described in detail on pages 32 and 33.

UNIQUE RATE-OF RISE

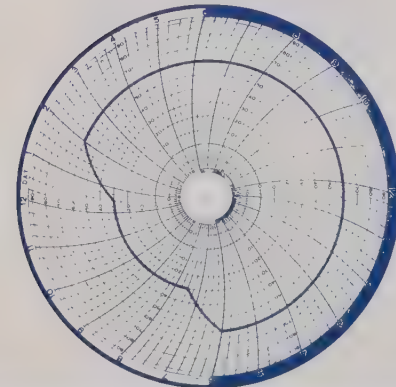
AN EXCLUSIVE BLUE M
OPTION THAT PROTECTS
CHAMBER AND WORKLOAD
THROUGHOUT ANY PROGRAM



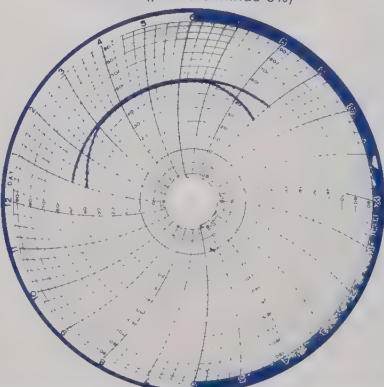
MIL E-5272C
4.4.1 Procedure 1
 $\pm 2^{\circ}\text{C}$ Dry Bulb Temperature
95% R.H. (plus 5% minus 0%)



MIL T-5422E
4.4.2 Steps 1, 2 and 3
 $\pm 2^{\circ}\text{C}$ Dry Bulb Temperature
95% R.H. (plus 5% minus 0%)



MIL E-16400D (NAVY)
Temperature Cycling 4.5.9.3
16 hours at 60°C , $\pm 5^{\circ}\text{C}$, 95% R.H. $\pm 5\%$
5 hours at 30°C , $\pm 5^{\circ}\text{C}$, 95% R.H. $\pm 5\%$



MIL E-16400D (NAVY)
Humidity Cycle—4.5.9.6
 50°C , $\pm 5^{\circ}\text{C}$, for 8 hours
50% R.H. $\pm 5\%$ to 95% $\pm 5\%$ in 2 hours
Hold 95% $\pm 5\%$ for 4 hours
95% $\pm 5\%$ to 40% $\pm 5\%$ in 2 hours

PROGRAMMING IN BLUE M CABINETS

TO INDUSTRIAL SPECIFICATIONS

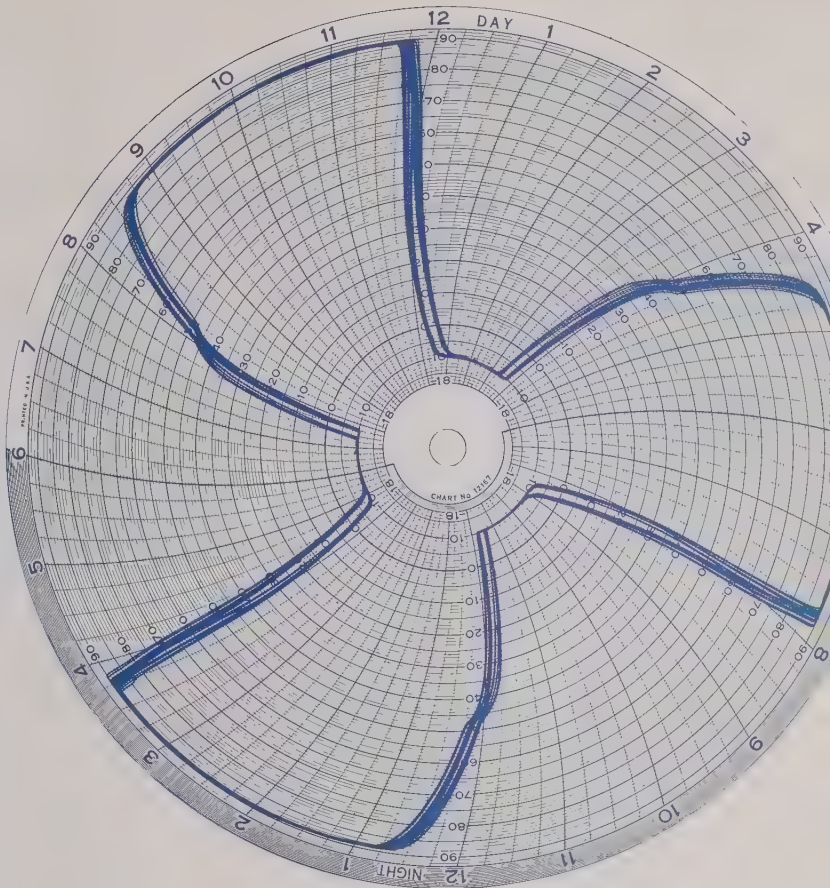
This circular chart recording illustrates the program capability and performance of a Blue M Full Range Constant Temperature/Humidity Cabinet when modified slightly to meet a special industrial test specification. This is an unretouched reproduction of an actual chart.

This specification—more severe than any MIL humidity spec.—calls for cabinet operation at +90°C. at 95% R. H. for four hours followed by a four-hour period of operation at -10°C. with uncontrolled relative humidity. Transfer time between the two extremes must be as rapid as possible.

This is a repetitive cycle and as the chart shows, the Blue M cabinet repeats this extremely difficult program with a remarkable degree of accuracy. Six cycles are shown.

It should be noted that this same program is being duplicated in four separate Blue M Temperature/Humidity Cabinets. Three of these units have chamber dimensions of 25" W. x 20" D. x 21" H. (5.8 cubic feet) and one measures 36" W. x 36" D. x 36" H. (27.0 cubic feet). All of them perform in the manner typified by this illustration. Incidentally, each unit is equipped with a toggle switch which permits the cabinet's operation to be changed from the one shown here back to its standard operating capability.

If you have a special temperature/humidity test requirement, we urge you to keep this example in mind. Very possibly Blue M will be able to meet it simply and economically.



OVERTEMPERATURE PROTECTION

Blue M's unique Rate-Of-Rise OTP lets you forget the possibility of excessive temperature rise once and for all! The illustrations show what it can do for you.

The chart at left shows a typical programmed cycle (heavy line). Blue M chambers can be equipped with a manually set overtemperature protection device which shuts down the unit if the temperature ever rises to the predetermined point at which it is set (dotted line).

Clearly this setting must be a few degrees higher than the highest point reached in a programmed cycle. If abnormal temperature rise should occur at the point shown in the illustration, however, it is very possible that the workload—heated suddenly at that particular stage of processing—could be ruined since it is a marked deviation from the established program.

Blue M's Rate-Of-Rise OTP eliminates this hazard. As the chart to the left shows, the OTP cut-off level (dotted

line) follows the program (heavy line) throughout the cycle. This OTP setting, just enough higher to avoid nuisance tripping, shuts down the chamber if it is reached at any point during the cycle. Since there is only a 3 or 4 degree difference between the program temperature and OTP settings, the workload will not be damaged in the event of failure.

This added safety is achieved by a second cam identical to the program cam. It is calibrated to provide the few degrees difference needed to activate the OTP. Since both cams are identical and are driven by the same mechanism, they remain synchronized to assure a degree of protection unequalled by any other system.

Blue M Rate-Of-Rise OTP is available on any programmed POWER-O-MATIC 60 chamber except one using a dual programmer-controller where the second cam is already in use to program.

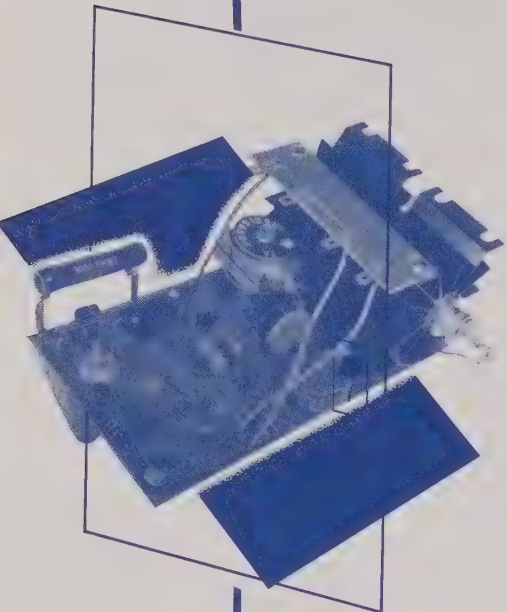
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Washington, Seattle 98108



BLUE M **POWER-O-MATIC 70**® PATENTED

Drawing upon the experience and knowledge acquired through the POWER-O-MATIC 60 and aided by the advances in electronic technology in the early 1960's, Blue M developed the POWER-O-MATIC 70 Control in 1967. This patented solid-state device also provides truly proportional, straight-line temperature performance, yet is directly competitive with out-moded, failure-prone on-off controls.

POWER-O-MATIC 70 is an advanced state of the art device, compact and precise. It consists of a temperature sensitive resistance network exercising phase control on two SCR's. Voltage is controlled by a Zener Diode. It has adjustable operating ranges from 0°C. to +300°C. Ranges are selected to match specific types of cabinets. It provides a control tolerance of $\pm 0.2^\circ\text{C}$. in mechanically convected models with super fast response to temperature changes measured in milli-seconds by the temperature sensor.

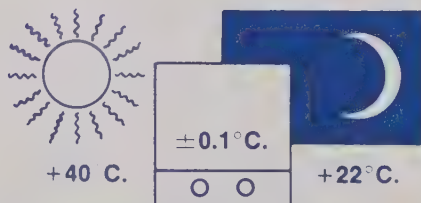
POWER-O-MATIC 70 and the new POWER-O-MATIC 80 described on the following pages allow Blue M to offer solid-state proportional performance for temperatures from 0°C. to +1620°C.

CABINETS IN THIS CATALOG EQUIPPED WITH

POWER-O-MATIC 70®
PATENTED

Of the equipment in this catalog utilizing POWER-O-MATIC 70 Control, only the 8 Cu. Ft. Batch Ovens on pages 100 and 101, and the High Powered Life Test Ovens on pages 116 and 117 are equipped with the system as it is described here. The other units feature POWER-O-MATIC 70 systems which have been modified somewhat to meet particular operating requirements. This is significant since the fact that the POWER-O-MATIC 70 can be so easily modified is a further (and ultimate) indication of its inherent versatility and design superiority.

ONLY **POWER-O-MATIC 70**® PATENTED



BUILT-IN AMBIENT TEMPERATURE COMPENSATION

Lets you ignore ambient temperature changes that can occur where your chamber is operating. Maximum temperature shift due to ambient temperature change of $\pm 5^\circ\text{C}$. is $\pm 0.1^\circ\text{C}$. through $+22^\circ\text{C}$. ($+72^\circ\text{F}$.) to $+40^\circ\text{C}$. ($+104^\circ\text{F}$.) range. Since such a wide ambient change is unlikely, your chamber will perform to close tolerances under all normal operating conditions.

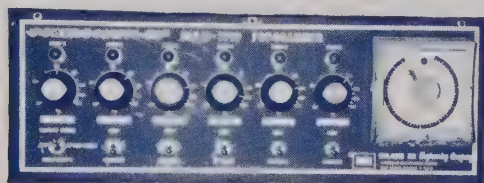


BUILT-IN LINE VOLTAGE COMPENSATION

The line voltage variations common in practically every installation are automatically compensated for. Maximum chamber temperature shift due to a line voltage change of ± 7 volts on 120 volt nominal line or ± 15 volts on 240 volt nominal line will be $\pm 0.1^\circ\text{C}$.

SOLID-STATE PROPORTIONING CONTROL SYSTEM

The Dual Thermal Shock Test Cabinets on pages 66-69 utilize a special POWER-O-MATIC 70 Control System which assures greater speed and response sensitivity. This kind of performance is essential in shock applications where wide temperature extremes must be met quickly and regularly. Such performance is not needed in conventional chambers.



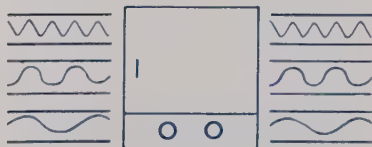
The 8 Cu. Ft. Batch Ovens described on pages 98 and 99 feature the unique POWER-O-MATIC 70 Multi-Step Programmer-Controller. Pictured above, this system enables all the excellent performance characteristics of the control to be channeled through prescribed operating patterns, and duplicated over and over at any time.

The Constant High Temperature Utility Oil Baths on pages 148 and 149 indicate further the flexibility of POWER-O-MATIC 70 since its superior performance capabilities are put to work here controlling liquid temperatures. When combined with the exclusive MAGNI-WHIRL® agitation system, POWER-O-MATIC 70 provides a remarkable control accuracy of $\pm 0.1^\circ\text{C}$.

UNIQUE WARRANTY

All equipment in this catalog is covered by Blue M's exclusive Warranty. This includes the individual units themselves as well as—in the case of the POWER-O-MATIC 70 Solid State Proportioning Control System particularly—the control instrumentation. Details of this Warranty are provided on pages 12 and 13. We urge you to review this material carefully. It is your final assurance of complete satisfaction with the Blue M chamber of your choice.

OFFERS YOU THESE OUTSTANDING ADVANTAGES



BUILT-IN INSENSITIVITY TO FREQUENCY

The POWER-O-MATIC 70 Control System has been engineered to operate from either 50 or 60 Hz. power lines. This means that in many cases one piece of equipment can be used in the U.S. and Europe.



BUILT-IN RFI SUPPRESSION

RFI (Radio Frequency Interference) is a high frequency disturbance caused by electrical equipment, and operating SCRs will all produce RFI. POWER-O-MATIC 70 has internal filtering networks to eliminate better than 90% of this "electrical noise." That which remains will cause no problem.



PATENTED MEMORY RING® CALIBRATING DIAL

Standard on all POWER-O-MATIC 70 chambers. All Blue M units are tested and calibrated with high quality strip chart recorders before shipment. The Memory Ring Dial lets you pinpoint any or all temperatures, and "remembers" every calibration factor for reproducibility. This assures fine control tolerances since you can manually compensate for variations not automatically handled by the chamber.

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NEW BLUE M



SOLID-STATE SCR PROPORTIONING CONTROL SYSTEM

LATEST ADDITION TO BLUE M'S OWN PROPORTIONING CONTROL SYSTEMS . . . DESIGNED SPECIFICALLY FOR CRITICAL STRAIGHT-LINE PERFORMANCE AT ELEVATED TEMPERATURES

The development, perfection and—now—expanded use of the POWER-O-MATIC 80 Control rounds out a research effort begun some years ago. Its purpose: to provide the industrial/test community with a line of superior Blue M controls—all fully proportional in operation—to match the broad temperature spectrum covered by our equipment.

The POWER-O-MATIC 80 can, essentially, be considered to be an extension of the popular and widely accepted POWER-O-MATIC 70 Control. The POWER-O-MATIC 70 provides reliable straight-line performance at temperatures to +300°C.; the POWER-O-MATIC 80 assures fully proportional performance at temperatures to as high as +1620°C. (+2950°F.)—the upper limit for equipment in this catalog.

Like its lower-range companion, the POWER-O-MATIC 80 Control is a modern solid-state device, efficient and compact. It includes a high gain solid-state amplifier and SCR's to modulate power to the heating elements, and incorporates the latest in solid-state technology—integrated circuitry. Plug-in modular design enhances reliability and simplifies routine inspection procedures. Rapid, accurate temperature sensing by means of a thermocouple matched to the specifications of the individual cabinet assures unusually fine response. A 10-turn potentiometer with Vernier dial, working in conjunction with Blue M's patented Memory Ring® Temperature Calibrating Dial, assures unmatched, pinpointed setability and repeatability.

Ease of operation complements the control's fine performance. Even inexperienced personnel can quickly and surely place the chamber in service—and keep it operating—with a minimum of training and supervision. Calibration and desired operating parameters are also maintained for extended periods without adjustment.

All the chambers in this catalog equipped with POWER-O-MATIC 80 feature built-in overtemperature protection as standard. This is separate, indicating type instrumentation with an indication accuracy of $\pm 1\%$ of full scale. By providing constant monitoring over the entire span, the operator sees what the chamber temperature actually is at all times. It operates independently of control in response to its own thermocouple, and features Blue M's exclusive MAX-SET™ time delay circuitry which eliminates nuisance tripping.

While a relatively new system, the POWER-O-MATIC 80 Control has undergone prolonged and extensive operational and field testing in the various chambers described in this catalog. This unquestionably indicates that it easily surpasses the performance of more costly solid-state instrumentation. Furthermore, it has the additional advantage of being engineered and built by Blue M exclusively for use in matched Blue M chambers to insure optimum performance.

POWER-O-MATIC 80 for the first time brings true straight-line, infinitely proportional performance—and all its advantages—to those performing critical work at high temperatures. It enables the discriminating buyer to have the superior performance he needs—regardless of operating requirements. As such, we honestly feel it is one of the most important contributions to control design ever made.



OUTSTANDING PERFORMANCE IS BUILT INTO EVERY CHAMBER EQUIPPED WITH **POWER-O-MATIC 80™** Patented

There are five series of high temperature Ovens and Furnaces in this catalog equipped with POWER-O-MATIC 80. All incorporate proven design and construction features which tailor them for dependable, long-life service at their elevated temperature ranges. The utilization of POWER-O-MATIC 80 now frosts the cake by assuring **performance** to meet their inherent physical qualities—performance which more than meets the most stringent in-service operating requirements.

Listed here are the various chambers in this catalog with POWER-O-MATIC 80 together with pertinent performance data to prove our point. A glance at these figures will verify what we say. After reviewing them, check the detailed information on the appropriate catalog pages. We wager you'll agree: for high temperature design and performance you can't find better chambers than those with POWER-O-MATIC 80.

INHERENT DESIGN EFFICIENCY OF LETS YOU PROGRAM ANY OF THESE CHAMBERS WITH YOUR CHOICE OF FINE COMMERCIAL INSTRUMENTS

The design and operation of the POWER-O-MATIC 80 Control has now been perfected to a point where the system lends itself to programming by means of commercial instrumentation. Not only can the operation of any POWER-O-MATIC 80 equipped chamber in this catalog now be regulated automatically, but you actually have a choice of such programming instrumentation to match your particular test/processing needs and budget exactly.

Brief descriptions of these two programming devices are given here. They will enable you to make a preliminary judgment as to which is best suited for your needs. Additional detailed information on both is available from your local Blue M Branch Office or direct from the factory.

OVENS
ULTRA-TEMP INERT GAS OVENS (PAGES 132/133)
TEMPERATURE RANGE: To +593°C. (+1100°F.)
CONTROL ACCURACY: $\pm 0.5^\circ\text{C}$.
COMBINED SETABILITY AND REPEATABILITY: $\pm 0.1\%$ of scale
AIR TEMPERATURE UNIFORMITY: At +300°C.: $\pm 3^\circ\text{C}$.
ULTRA-TEMP INERT GAS OVENS WITH PROGRAMMING (PAGES 134/135)
TEMPERATURE RANGE: To +593°C. (+1100°F.)
REPEATABILITY: $\pm 2^\circ\text{C}$.
AIR TEMPERATURE UNIFORMITY: At +300°C.: $\pm 3^\circ\text{C}$.
ULTRA-TEMP OVENS (PAGES 138/139) Illustrated
TEMPERATURE RANGE: 12°C. above ambient to +704°C. (+1300°F.)
CONTROL ACCURACY: $\pm 0.5^\circ\text{C}$.
COMBINED SETABILITY AND REPEATABILITY: $\pm 0.1\%$ of scale

FURNACES
RAD-O-GLOW GLOBAL® FURNACES (PAGES 170/171) Illustrated
TEMPERATURE RANGE, INTERMITTENT: +1620°C. (+2950°F.)
CONTROL ACCURACY: $\pm 3^\circ\text{C}$.
STABIL-GLOW BOX TYPE FURNACES (PAGES 174/175)
TEMPERATURE RANGE, INTERMITTENT: +1204°C. (+2200°F.)
UNIFORMITY: $\pm 1\frac{1}{2}\%$ of setpoint
CONTROL ACCURACY: $\pm 2^\circ\text{C}$.

POWER-O-MATIC 80™ PATENTED

CAM-TYPE TIME-PROGRAMMED SETPOINT CONTROL

This is a simple, relatively inexpensive remote setpoint device. It consists, essentially, of a cam motor mechanism which winds or unwinds a single turn potentiometer in relation to a cam slope. Once the cam is cut to the desired program, chamber temperatures are regulated with a good degree of accuracy and repeatability. The instrument can be quickly and easily installed on any new or existing POWER-O-MATIC 80 controlled chamber. It is supplied with a 24-hour cam motor as standard with 2, 3, 4, 6 and 12-hour and 3, 4 and 7-day motors optional if specified. A single blank cam is standard, with cams cut to order available at an extra charge. As a general rule, use of this instrument is recommended for applications where maximum programming accuracy can be sacrificed for economy.

CAMLESS DRAWN-LINE PROGRAMMER

Programmed control with the Data-Trak is accomplished by simply drawing a line on a coated Mylar chart. A servo-driven probe seeks the center of the line, providing repeatability to 0.02%. Since probe is non-contacting, there is no chart wear and programs are reusable. The output potentiometer is a 3-turn type, thus offering three times the discrimination capability of the cam-type unit above. Also, the discrimination is much better over the instrument's 11" chart width. The unit comes with two back-up microswitches to give a functional operation once per drum revolution, and a photo-electric switch which gives a functional operation as many times per revolution as desired. While more costly than the cam-type instrument, the device offers greater operational flexibility and convenience, and should be considered for applications where fine performance is paramount.



SEND FOR ADDITIONAL INFORMATION AND ALL PRICES

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New York, Elmsford 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
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Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

BLUE M ENVIRONMENTAL CABINETS

Since by definition the purpose of an environmental chamber is to artificially duplicate and maintain for a prescribed time a specific natural environment, any number of different kinds of chambers could fit this description. A home refrigerator, for example. Or a household oven. Or an air conditioned car.

Thus defined, every unit in this catalog is an environmental chamber. They all duplicate conditions of heat, humidity or cold. But for convenience sake, we have confined this Environmental Section to

Temperature/Humidity Cabinets, Refrigerated Test Chambers, and Thermal Shock Test Chambers. Most of these units duplicate two environments. The Temperature/Humidity Cabinets duplicate two environmental conditions simultaneously, and are in fact the most sophisticated means to accomplish this ever developed. Their acknowledged superiority over similar competitive equipment by actual users is thus a true measure of the quality and reliability of all the other equipment in this catalog.

BLUE M TEMPERATURE/HUMIDITY CABINETS



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BLUE M REFRIGERATED AND SHOCK TEST CHAMBERS

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*The Broad -185°C. to +200°C. (+392°F.) range of these units makes them very suitable for Thermal Shock Test applications where exposure to extremes of heat and cold in a single chamber is desirable but where automatic cycling is not required.

**Although included in the Bath Section of this catalog, these units are ideally suited for Thermal Shock Test applications. They meet Mil. Std. 883, Method 1011, Conditions A to F as well as innumerable commercial applications.

BLUE M

CONSTANT TEMPERATURE/HUMIDITY CHAMBERS

When these units were introduced several years ago, a lot of people thought they were too expensive. Other humidity chamber manufacturers could underbid them. And people bought competitive units because they were "only" testing to MIL Specs. They didn't need equipment that controlled as precisely as Blue M's.

Now this attitude has completely reversed. People who once "didn't need equipment that good" now wonder if it's good enough. And it's the same equipment—only improved.

Equally surprising—they're the same specs! If anything, these specs (Mil 202D, for example) have been relaxed considerably.

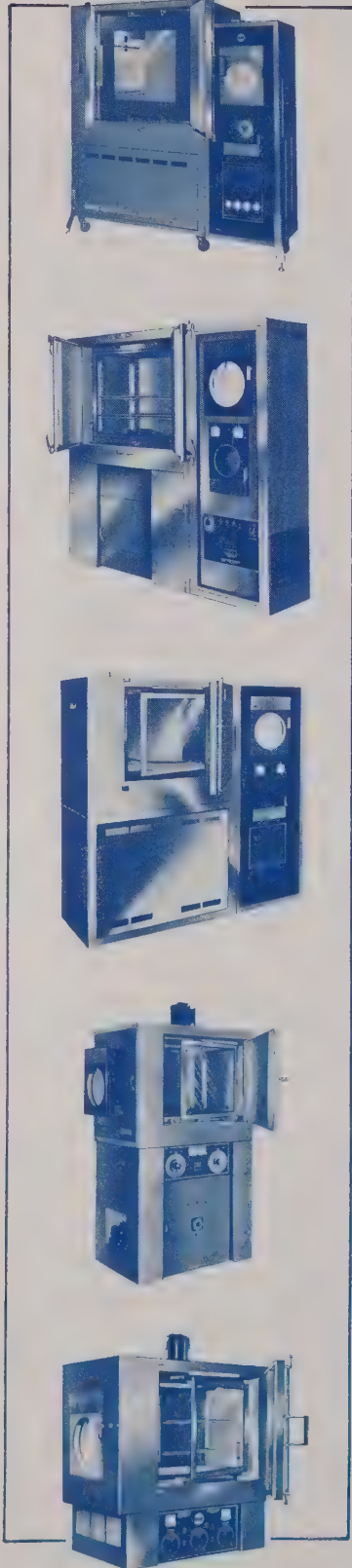
The reason for this change in attitude lies in a much more strict policing of those testing to MIL Specs and an insistence that the requirements of the specification actually be met. Disappearing are the days when empty cabinets were run constantly to obtain recorder charts as "proof" that any given product run met the specified requirement. Today if you are qualifying to MIL Specs, you had better test to MIL Specs!

A lot of people can't; their present equipment just won't do the job. And a lot of new equipment on the market won't either.

The Blue M Temperature/Humidity Cabinets described in this catalog will—just as they have for years. We can point to hundreds of field installations where these specifications are being accurately and reliably met—day in, day out. Look over the list of typical MIL Specs that these cabinets meet at the back of this introductory section. Chances are, one or more of them will be on your list of requirements. (That list, incidentally, will also give you a good idea of the kind of general industrial specifications—your own or your customer's—that these units can meet.) And remember, please: these units will actually meet them, easily.

On the following pages we describe some of the unique design and operating features that make this performance possible—plus actual proof of this performance in the form of charts and graphs. We urge you to read this material carefully. It will help convince you that Blue M Environmental Equipment is just what we say it is . . . the finest of its kind ever built!

We emphasize that the units described on later pages are only representative examples of our ability. For the most part, these units were designed to meet certain common—though strict—requirements. Perhaps your needs are different. If so, please contact your nearest Blue M office or write us direct. Chances are excellent that we have already met and solved your particular problem—or can solve it easily and economically—with our broad environmental equipment capability.



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Only From BLUE M . . .

TSC

TOTAL SYSTEM
CALIBRATION

**INSTRUMENTS SHOW
CHAMBER CONDITIONS
AS THEY REALLY ARE—
NOT AS THE MANUFACTURER
WANTS YOU TO THINK
THEY ARE!**

**READ THIS AND BE
CONVINCED . . .
THE TEMPERATURE
SENSOR AND
THE TEMPERATURE
INDICATOR
SHOULD BE
DIFFERENT!**

Most manufacturers of temperature/humidity chambers use recording-controlling instruments. These—as the name implies—both control the conditions in the chamber and record these conditions visually. Arguments used to justify this type of arrangement include such old stand-bys as “simplicity,” “economy,” “efficiency” and perhaps even “reliability.”

Assuming (and it's a big assumption) that any of these arguments are really true, manufacturers using this kind of equipment conveniently forget to mention the major and inherent flaw in such a system: the recording instrument is literally a slave to the set index. Once the temperature setting has been made, the recorder must show what the controls tell it to show. The controls, mind you, not what the actual conditions are in the chamber! Perhaps this doesn't seem to be too much of a problem. After all, if the controls are accurate . . . if they do truly reproduce the desired set conditions in the chamber . . . then the recording instrument will show just what is going on inside.

And that's the point. Conditions in any chamber using a combination recorder-controller can't match the control setting and still be faithfully and accurately recorded. There will always be a difference between what the recorder shows and what is going on inside—sometimes with serious consequences.

The reason for this discrepancy is easy to understand. For simplicity, we'll just talk about controlling temperature at this point. Conditions of temperature must be controlled by sensing elements. The control is set for the desired temperature. When the sensing element “feels” that the correct temperature has been reached, it causes the control (in the case of conventional on-off devices) to shut down. When the chamber temperature drops sufficiently, the sensing element “feels” the change and turns on the control. And so on. The same is true of humidity sensing elements. The big question is: where do you place the sensing element?

To maintain close control characteristics with on-off systems, the closer the sensor is placed to the heating elements the better. This enables the heat sensor to detect the alternate heating and cooling of the elements quicker, and results in closer control with a minimum of overshooting and undershooting. (You still will get a “saw-tooth” effect, but at least the peaks and valleys are not so severe.) Clearly, the further the heat sensor is moved from the heat source, the longer it will take for the rise or drop in temperature to be “felt” and for the control to be activated accordingly.

Now think for a moment what this means when the recorder and controller use the same sensor. If the sensor is placed close to the heating elements to obtain close control, it will automatically “feel” a higher temperature than is present in the chamber where the workload is. The recorder will naturally show that temperature—even though actual chamber temperature is considerably less.

Conversely, placing the sensor away from the heat source will enable it to “feel” (and cause to be recorded) a more realistic indication of actual chamber conditions, but at the sacrifice of control accuracy. Those peaks will begin to look like mountains!

The most common solution for this enigma is to place the sensor close to the heating elements (to obtain fairly good control) and to calibrate the recorder so that its readings correspond to the temperature setting. (Naturally, this doesn't alter the actual chamber temperature, but it does serve as a guideline for the operator, and reassures the uninitiated that what he sees is actually what he is getting.) Of course, such a calibration is good only for the specific temperature at which it is made. The recorder must be recalibrated every time a new temperature is set—a complex procedure which is impossible whenever programming is introduced.

Conventional calibration procedures, too, often provide misleading results. The sensors are removed from the chamber and checked against a known value. If the results are satisfactory, the sensors are placed back in the cabinet and it is assumed that all temperature settings are being faithfully reproduced inside the work chamber on the basis of one or two verifications outside. This—once again—when the sensors are not even placed in the work chamber during operation. Clearly, such “calibration” is hardly worthy of the name.

The only truly satisfactory solution (and a moment's thought will verify that it's the only reasonable one) is the method employed on all Blue M equipment. Blue M uses two sensors. One regulates chamber temperature. It is placed near the heat source for fast response. The second, from the recorder, is placed in the work chamber so that it "feels" exactly the same conditions experienced by the workload. A glance at the recorder tells the operator exactly what is going on inside the work chamber.

Blue M's calibration procedure, too, is logical—and thorough. First, the recorder is calibrated. It becomes the guide. The controls are then calibrated against it. And since the recorder does nothing but monitor what's going on inside, it must show exactly the conditions to which the workload is being subjected. The recorder is the slave of the cabinet.

This same principle is applied to Blue M Temperature/Humidity Cabinets, only here, four sensors are used: one each to control temperature and dew point and one each for wet and dry bulb temperatures. Again, keeping the recording instrument separate and distinct from the control system assures the user a clear, precise and meaningful indication of actual chamber conditions.

This is what we mean by TSC—Total System Calibration. The entire system is in calibration—not just the indicating instruments. Everything—chamber, controls, recorder—functions as a single, perfectly balanced test facility whose reliability and accuracy can be relied upon (and checked visually) with absolute confidence.

One more important point. Like any mechanical device, environmental cabinets—including Blue M's—are subject to wear and possible failure, particularly after they've been in service for some time. And one of the most common trouble spots is the sensing bulb.

When the temperature sensor fails, for example, very often it develops a slow leak. This causes it to gradually become less sensitive to heat. This, in turn, causes more heat to be applied by means of compensation. The chamber temperature will gradually rise.

In a chamber with a single temperature sensor for heating and recording, this change will never show on the recorder. The chart will look perfectly normal because the sensor "feels" normal—even though actual chamber temperature is many degrees hotter than it should be. If this should occur during a prolonged test, very possibly a valuable workload and chamber could be lost—not to mention the loss of valuable process time.

This cannot happen with a Blue M cabinet. Any and all changes in chamber conditions are detected separately and transmitted at once to the recorder graph. The operator can tell at a glance that something is amiss and can take steps to correct it before damage or loss occurs.

And finally: unless you have an accurate, reliable indication of actual chamber conditions, you may well be throwing thousands of dollars down the drain. Suppose, for example, that you have designed a component or part which must pass certain rigid specifications. Upon testing the prototype, you find that it fails. It must be redesigned. If it fails again, it will have to be reworked again. And so on until it meets the specs. This all takes time and money.

We can cite several cases where this has happened—cases where the fault has not rested in the component, but in the test apparatus. Actual chamber performance and instrument indication were so different, that the part under test was being subjected to conditions which far exceeded specs in severity. Yet according to visual indication, the chamber and workload were meeting requirements exactly. When the parts were re-tested in a Blue M chamber, they passed without difficulty. And these were the parts as they were originally designed—before inaccurate testing erroneously called for their modification. All the time, effort and money spent in re-working them was wasted. Very probably this needless expense amounted to more than enough to purchase a Blue M chamber in the first place. Before buying any environmental chamber, ask yourself this question: "When I look into the work chamber, do I see the sensing bulb?" You should, because that's where the workload will be and where the conditions you wish to duplicate must be established.

GRAPHIC PROOF OF BLUE M'S SUPERIOR PERFORMANCE

We could talk all day and not convince anyone that Blue M Temperature/Humidity Cabinets are as good as we say they are. You really have to see them operate to believe it (and you're welcome to visit our plant any time to do just that).

Short of a first-hand demonstration, the next best thing is visual proof of chamber performance. And we provide it on the following pages. We've reproduced actual differential charts taken from standard Full Range Temperature/Humidity Cabinets. Such recordings are, we believe, as accurate a measure of cabinet performance as can be found. Please look at them and read the explanation of them. (Remember. These are typical charts. We have many others we'll be pleased to show or send you on request.) Then ask any other manufacturer of this kind of equipment for a similar chart. Compare them.

Since it's results that count, compare results. You'll quickly agree: Blue M's claim of offering the finest environmental equipment on the market is much more than a claim. It's a fact!

HERE'S CONVINCING PROOF OF BLUE M'S SUPERIOR PERFORMANCE

This is an exact reproduction of a differential recording, slightly reduced in size. It shows a portion of MIL-202D, Method 106C, Steps 1-7. It was run on a standard Blue M Full Range Constant Temperature/Humidity Cabinet (Model FR-256PC) with Dual Wet and Dry Bulb POWER-O-MATIC 60® Saturable Reactor Control Systems, described on page 32. We have selected this particular program by way of illustration because performing to this specification is one of the more common uses to which this cabinet is put. However, this cabinet and the other Blue M Temperature/Humidity units described on later pages are fully capable of meeting any military or industrial specification within their prescribed temperature and humidity ranges.

The differential recording corresponds to the circular chart recording to the left. That portion of the circular chart recording covered by the differential recording is shown by the two arrows. The differential is read from right to left. In effect, the differential is an enlarged or magnified view of the chamber conditions recorded on the circular chart, and serves as verification of these conditions.

The differential instrument used has a scale range of 0°C. to +10°F., 1°F. increments. Chart speed: 2" per hour. Accuracy: $\pm 1/5$ of 1% of scale ($\pm 0.020^\circ\text{F}.$).

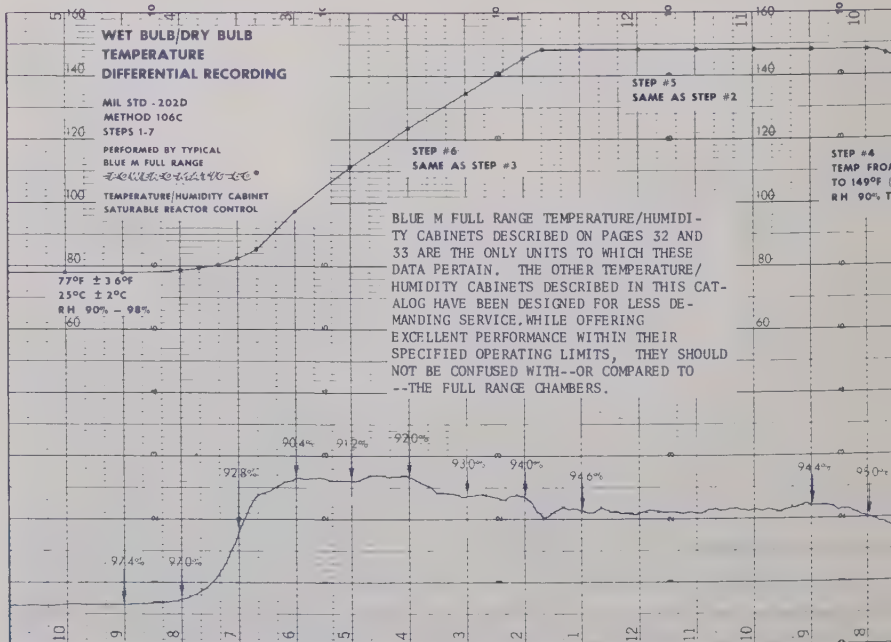
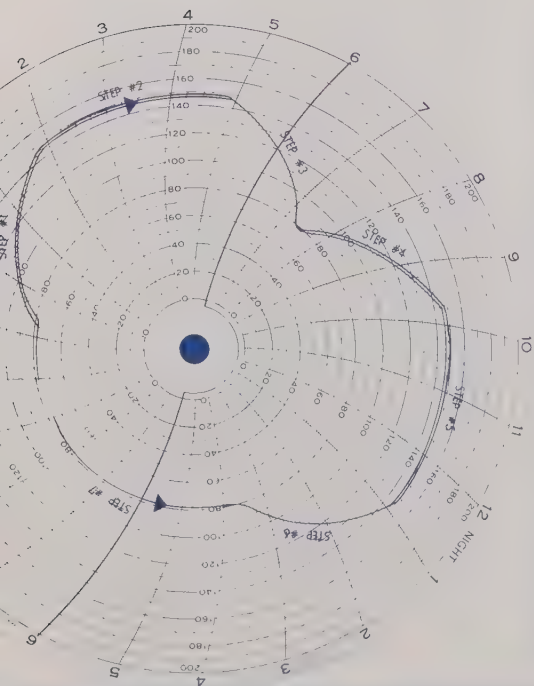
The top line on the differential chart shows dry bulb temperature at any given time in the cycle. It was plotted by hand from points taken directly from the circular chart, and has been added here for easy reader

reference. The lower line—the actual recording—represents the depression in terms of absolute value for the temperatures shown. The depression is read from the 0° line on the chart to the recorded line. This value is related to the dry bulb temperatures and then referenced to a special psychrometric table (included at the back of this catalog) computed in tenths of a degree for actual determination of relative humidity. It should be noted that the differential recording results from two sensing bulbs driving a single pen. These bulbs are located in the same position as for the circular chart.

Blue M has selected differential recordings as a means to double check cabinet performance. We feel that they offer convincing proof of the performance of our equipment. The example shown here is typical. Every Blue M Full Range Temperature/Humidity Cabinet now in service has the same capability . . . provides users with this kind of demonstrable performance, test after test, run after run.

Blue M has actual 24 hour differential recordings available for your inspection. Before you purchase any humidity cabinet, review a Blue M differential recording . . . compare it with the recordings available from any other manufacturer. Prove to yourself the superiority of Blue M Temperature/Humidity Cabinets over any competitive equipment available today.

For a lucid and more detailed description of the advantages and use of differential recorders, please see catalog pages 184-187.



IF YOU'VE WORKED WITH OLD FASHIONED TEMPERATURE/HUMIDITY CABINETS YOU'VE LIVED AT LEAST ONE OF THESE MAJOR PROBLEMS

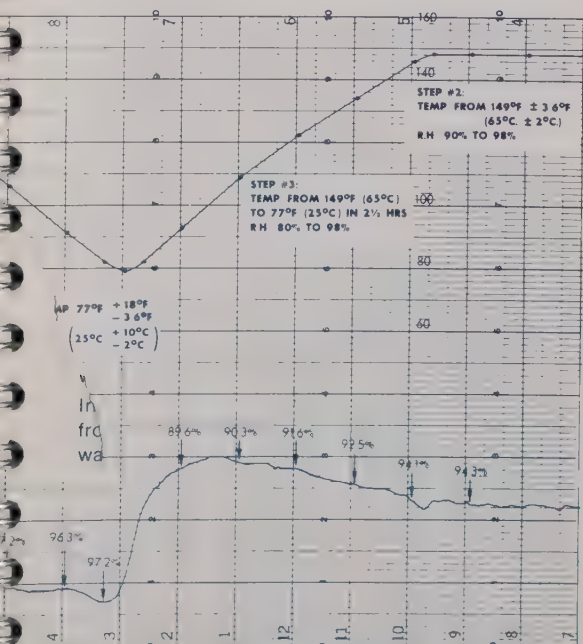
(If you have only used Blue M equipment, you'll have to take our word that these problems do exist. Or ask a user of equipment competitive to Blue M for verification.)

CONTROLS THAT INVITE TROUBLE

Out-moded on-off controls have fixed differentials . . . can't compare with the differential performance we've demonstrated on earlier pages—and are prepared to prove in person any time. These systems also have a maze of complicated mechanical linkages between the programmer and recorder—wonderfully intricate nightmares that require an advanced degree (of education or experience plus patience) just to keep them operating. Not to mention constant contact wear and/or failure which somehow always seems to cause a control crisis in the middle of a long test.

CYCLING COMPRESSORS

Instead of operating continuously like Blue M's, competitive compressor systems cut on and off. Besides shortening compressor life and increasing maintenance, this on-off action causes an appreciable variation in chamber conditions every time the compressor slams on. Blue M also offers fine capacity control . . . the full capacity of the compressor is used only when it's needed, not all the time. Compressor performance is geared exactly to the operating temperature requirements of the chamber at all times. Blue M compressors have capacity-plus to do the job, yet the cost of operating them is kept to a minimum.



WAY-OUT WATER SYSTEMS

You're apt to find as many different ways to handle water in humidity chambers as there are chamber manufacturers. You'll find spray systems, complex steam injection systems, and several others. While they do get water into the chamber, very often it is in a form (drops, mist, etc.) that can hardly be considered as a duplication of an actual environmental humidity condition (unless it happens to be raining!). Beyond this primary failing, these systems are inherently maintenance-prone requiring regular cleaning, adjusting and parts replacement. Blue M, on the other hand, offers a reliable solid-state water leveling system and an exclusive vapor-pressure system that even eliminates wet bulb control wicks. Blue M builds true temperature/humidity chambers—not heated water boxes. And recognizing that corrosion is a major problem even in stainless cabinets, Blue M has developed the Crystal Clear Water Purification System, described on later pages, which provides high resistance pure water, successfully fights corrosion, and improves chamber operational efficiency.

CORNER-CUTTING CONSTRUCTION

This is a common and easy way to keep initial cost low. Mediocre materials may look all right in the show-room but they'll quickly result in mediocre performance (at best) in service. All materials and components in Blue M Temperature/Humidity Chambers are carefully selected for the rugged service in which they will be used. We start with heavy gauge type 316 stainless interiors, for example, heli-arc welded and with all welds passivated. The result is a quality unit offering years of efficient, maintenance-free life. No substitute materials, ever, in Blue M construction—inside or out.

TYPICAL MIL SPECIFICATIONS MET BY BLUE M TEMPERATURE/HUMIDITY CABINETS

MIL 202D, METHOD 106C, STEPS 1-7A
MIL 202D, METHOD 103B, CONDITION D
MIL E-5272C, 4.4.1 PROCEDURES 1 AND 3
MIL T-5422E, 4.4.2 STEPS 1, 2 AND 3
MIL E-16400D (NAVY), TEMPERATURE CYCLING 4.5.9.3
MIL E-16400D (NAVY), HUMIDITY CYCLE 4.5.9.6
MIL E-1E, METHOD 1011
MIL-STD-170 (SIG C)
MIL STD. 810, METHOD 507, STEPS 1, 2, 3 AND 4
MIL STD. 883

While by no means all the tests possible with these cabinets, this list will nevertheless serve as a good indication of their broad capabilities. It goes without saying that the most difficult portions of these tests represent a useful guide to the kind of individual industrial test specifications these units are capable of meeting.

BLUE M EQUIPMENT

A SALES AND SERVICE BRANCH OF
BLUE M EQUIPMENT COMPANY
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California, Sunnyvale 94086
Florida, Orlando 32789
Georgia, Atlanta 30341

Illinois, Blue Island 60406
Massachusetts, Framingham 01701
Michigan, Allen Park 48101
New York, Elmsford 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

APPLICATION: How to meet any MIL. STD humidity specification with absolute stability, reliability and accuracy.

OPERATING AND CONTROL CHARACTERISTICS

TEMPERATURE RANGE
-18°C. to +93°C. (+200°F.)

RELATIVE HUMIDITY RANGE
See Chart 1-318-11A-1

STABILIZATION TIME
+25°C. to +93°C.: 1 hour (approx.)
+25°C. to -10°C.: 25 minutes (approx.)
+93°C. to +25°C.: 2½ hours (approx. Cam angle limitation)

STABILITY
(Over 24 hr. period steady state)
Temperature: $\pm 1/2^\circ\text{C}$.
Relative Humidity: $\pm 1/2\%$.

RECOVERY TIME
Average recovery of stabilized temperature and relative humidity when door is opened 5 minutes or less: 25 minutes at +65°C.

SOLUTION:

BLUE M FULL RANGE CONSTANT TEMPERATURE/HUMIDITY CABINETS

with Dual Wet and Dry Bulb **POWER-O-MATIC-60** Saturable Reactor Control Systems, Programming, and Separate Monitoring Recorder.

These maximum capability cabinets—designed primarily to perform all current MIL. STD. humidity tests including those listed on page 31—are without question the finest units of their kind ever built. A clear indication of the capabilities of these chambers is offered by the data on pages 28-31. This information pertains directly to these chambers and should be considered carefully before a choice of any temperature/humidity cabinet is made.

Also, these units include programming and a separate quality monitoring recorder to provide a visual record of performance. However, for the ultimate proof that the chamber is indeed complying to the test specifications, we recommend the use of a differential recorder as described on pages 184-187. These Blue M cabinets are the only ones in the country that can withstand this scrutiny—additional evidence of their unsurpassed performance. This coupled with the outstanding design and construction features outlined below make these chambers the logical choice to meet the most severe military and industrial test requirements.

SPECIAL CAPABILITY: MIL-202D, METHOD 106C STEP 7A

Cabinet automatically performs Step 7A (-10°C.) without changing cams. Test components need not be removed to cold chamber.

Program cam trips auxiliary switch that activates drain valve and transfers refrigeration circuit from minimum to maximum. Selector switch on control panel may be set at either -10°C. cycle or +25°C. holding cycle.

GENERAL SPECIFICATIONS

CONTROL SYSTEM

POWER-O-MATIC 60 Dual Saturable Reactor Proportioning Control Systems with programming.

SEPARATE MONITORING RECORDER—2 pen, wet and dry bulb, 24 hour chart drive. Range: -18°C. to +93°C. Accuracy $\pm 1\%$ of scale. Calibrated at +65°C., $\pm 1/2^\circ\text{C}$. Not connected electrically or mechanically to control system. Monitors and provides records only. 100-12" diameter charts, pens and all accessories included. Set of cams—blank or cut to your program—also supplied.

REFRIGERATION COMPRESSOR SWITCH • PILOT LIGHTS • AUTOMATIC ELECTRONIC WATER LEVELER • MAIN CIRCUIT BREAKER • VOLT-METERS • REFRIGERATION PRESSURE GAUGES • ELAPSED TIME METER • MAX-SET™ OVER-TEMPERATURE PROTECTION

CONSTRUCTION

HOUSING—heli-arc welded, all polished stainless.

INTERIOR—type 316, 17-12 stainless. Heli-arc welded and passivated. Removable parts electro-polished.

EXTERIOR—polished type 304, 18-8 stainless. Removable front and back panels of expanded steel and finished to match control console.

INSULATION—Fiberglas.

HARDWARE—exclusive adjustable no-slam, cam action latch and chrome-plated hinges.

DOOR(S)—same construction and insulation as cabinet. 11, 27 and 64 cubic foot models have double doors but no center mullion. Silicone rubber seal.

INNER GLASS DOOR—stainless framing, latches and fittings. Heavy plate tempered glass; viewing area approximately chamber I.D.

SHELVES—two, adjustable every 2". Electropolished stainless, wire type.

CONSOLE INSTRUMENT CABINET—heavy gauge cold rolled steel, houses reactors, controls, recorder, etc. Attractive blue enamel finish.

MECHANICAL REFRIGERATION—dual cooling system, non-cycling—constant operation. Copeland semi-hermetic, industrial type using refrigerant 12. High quality with full rated capacity.

VAPOR PRESSURE SYSTEM—in lieu of atmosphere spray. No wet bulb control wicks to change.

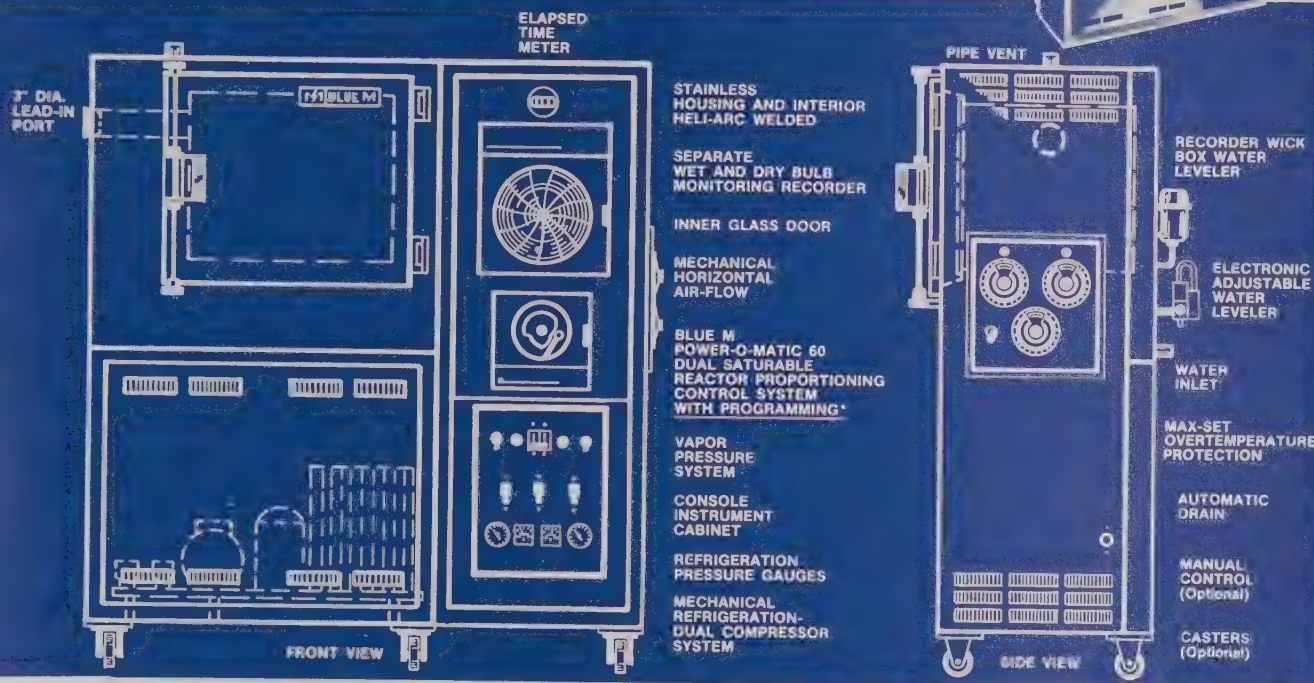
WATER FLOW AND LEVEL SYSTEM—quality type strainer, pressure regulator valve, flow control solenoid valves and electronic water leveler meter water exactly on long-term basis. Unique stainless gravity water leveler accurately and visibly provides required level; overflow outlet. No needle or float valves. Nominal water use.



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STANDARD

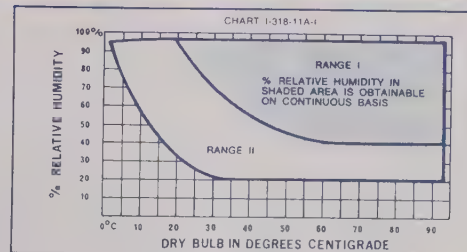
ENVIRONMENTAL



NOTE: Continuous operation at dew point conditions of 3°C. or lower will produce icing of water reservoirs.

Continuous suction line cooling of return hot gas permits continuous operation at +93°C. without compressor damage.

RANGE I:
STANDARD MIL. STD. RANGE
RANGE II:
PROGRAMS QUOTED TO ORDER



***NOTE:** IN ADDITION TO DUAL PROGRAMMED CONTROLS, AUXILIARY WET AND DRY BULB CONTROLS AND TOGGLE SWITCH ARE OPTIONALLY AVAILABLE TO PERMIT MANUAL OPERATION WITHOUT CAMS.

WET BULB RECORDER WICK CONTAINER—1/2 gallon bottle in stainless rack. Gravity feed provides wick with distilled water.

OPERATION

Turn on cam drive. In controlling relative humidity, specific water reservoir dew point temperature is maintained by continuously operating submerged cooling coil and wet bulb heating element. The exact temperature is maintained by the wet bulb control bulb which senses water temperature and meters proper voltage to the heaters through the wet bulb POWER-O-MATIC 60 Control System.

In controlling chamber temperature, air, withdrawn from chamber by blower wheel, is propelled across water surface for chilling and saturation to proper dew point temperature. It then passes over dry bulb heaters, is heated to set dry bulb temperature, and discharged into working area. Heaters are controlled by the dry bulb POWER-O-MATIC 60 Control System. Temperature and humidity are controlled, sensed and recorded by separate instrument in accordance with the program outlined on the cam to meet any condition shown on chart.

Model Number	Inside Dimensions Inches (Cm.)			**Overall Dimensions Inches (Cm.)			Total KVA	Voltage 60Hz. A.C.	Cubic Feet Cap.
	W.	D.	H.	W.	D.	H.			
FR-256PC-1	25 (63)	20 (51)	21 (53)	68 (172)	38 (95)	70 (177)	10.8	240 V./1 Ph	6.0
FR-386PC-1	37 (93)	20 (51)	26 (65)	80 (203)	38 (95)	74 (187)	14.4	240 V./1 Ph	11.0
FR-366PC-1	36 (90)	36 (90)	36 (90)	79 (200)	54 (136)	79 (200)	19.2	240 V./1 Ph	27.0
FR-446PF-2	48 (120)	48 (120)	48 (120)	99 (251)	65 (165)	89 (226)	31.5	240 V./3 Ph	64.0

**Overall dimension width includes 25" wide console control cabinet.

All wiring complete and enclosed to meet N.E. Code, as amended.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: EXTRA CHARTS, EXTRA SHELVES, ELECTRICAL TERMINALS, LEAD-IN PORTS, CRYSTAL-CLEAR WATER PURIFICATION SYSTEM, EXTRA DEMINERALIZING CARTRIDGES, INTERIOR LIGHT AND SWITCH, NEOPRENE RUBBER GLOVES AND/OR PORTS/PLUGS FOR INNER GLASS DOOR, LOCKING CASTERS, LEVELING LEGS, MANUAL CONTROLS, HUMID-PAC ACCESSORY KIT, AND DIFFERENTIAL RECORDER.

SEND FOR ADDITIONAL INFORMATION AND ALL PRICES

BLUE M EQUIPMENT

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California, Sunnyvale 94086
Florida, Orlando 32789
Georgia, Atlanta 30341

Illinois, Blue Island 60406
Massachusetts, Framingham 01701
Michigan, Allen Park 48101
New York, Elmsford 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

APPLICATION: How to reliably meet operational requirements down to $-38^{\circ}\text{C}.$ in a temperature/humidity cabinet of acknowledged superiority.

OPERATING AND CONTROL CHARACTERISTICS

TEMPERATURE RANGE
 $-38^{\circ}\text{C}.$ to $+93^{\circ}\text{C}.$ ($+200^{\circ}\text{F}.$)*

RELATIVE HUMIDITY RANGE
See Chart I-318-11A-1.

STABILIZATION TIME
 $+25^{\circ}\text{C}.$ to $+93^{\circ}\text{C}.$: 1 hour (approx.)
 $+25^{\circ}\text{C}.$ to $-38^{\circ}\text{C}.$: 60 minutes (approx.)
 $+93^{\circ}\text{C}.$ to $+25^{\circ}\text{C}.$: 2½ hours
(approx. Cam angle limitation)
Maximum recommended hold down time at $-38^{\circ}\text{C}.$: 24 hours

STABILITY
(Over 24-hr. period steady state)
Temperature: $\pm 1/2^{\circ}\text{C}.$
Relative Humidity: $\pm 1/2\%$.

RECOVERY TIME
Average recovery of stabilized temperature and relative humidity when door is opened 5 minutes or less: 25 minutes at $+65^{\circ}\text{C}.$

*Unit can be modified for operation to $+150^{\circ}\text{C}.$ for special applications. Please contact factory for information.

SOLUTION:

BLUE M EXTENDED RANGE CONSTANT TEMPERATURE/HUMIDITY CABINET

with Dual Wet and Dry Bulb **POWER-O-MATIC 60**® Saturable Reactor Control Systems, Programming and Separate Monitoring Recorder.

This all-new Blue M Temperature/Humidity Cabinet fulfills the growing demand for a reliable unit with an unusually wide temperature range for in-house programs requiring a temperature "dip" of $-38^{\circ}\text{C}.$ for periods up to 24 hours. By providing an operating range from $+93^{\circ}\text{C}.$ down to $-38^{\circ}\text{C}.$, this unique chamber enables the discriminating buyer to purchase a single programmed unit which meets all current MIL. STD. humidity tests plus any specialized test needs calling for operation at temperatures well below those required by Government contract.

The development of this fine extended range unit is a natural outgrowth of Blue M's unequalled experience in temperature/humidity cabinet design. It incorporates many features of Blue M's Full Range Temperature/Humidity Cabinets—acknowledged as easily the best units of their kind ever built—plus a number of important innovations to provide its very versatile sub-ambient temperature range. These include such design features as an exclusive heavy-duty single stage mechanical refrigeration system, extra heavy dual insulation, and numerous special construction details which assure peak performance throughout its wide operating range.

Please note that while this cabinet provides absolutely reliable performance at $-38^{\circ}\text{C}.$ for up to 24 hours, it is not intended for steady-state service at this temperature. For such service, we recommend our Versa-Range® Test Chambers designed for sub-ambient operation over extended periods.

SPECIAL CAPABILITY: MIL-202D, METHOD 106C STEP 7A

Cabinet automatically performs Step 7A ($-10^{\circ}\text{C}.$) without changing cams. Test components need not be removed to cold chamber.

Program cam trips auxiliary switch that activates drain valve and transfers refrigeration circuit from minimum to maximum. Selector switch on control panel may be set at either $-10^{\circ}\text{C}.$ or lower cycle or $+25^{\circ}\text{C}.$ and higher holding cycle.

GENERAL SPECIFICATIONS

CONTROL SYSTEM

POWER-O-MATIC 60 Dual Saturable Reactor Proportioning Control Systems with programming.

SEPARATE MONITORING RECORDER—2-pen, wet and dry bulb. Accuracy $\pm 1\%$ of scale. Not connected electrically or mechanically to control system. Monitors and provides records only. 100 - 12" diameter charts, pens and all accessories included. Set of cams—blank or cut to your program—also supplied. Ranges: $-40^{\circ}\text{C}.$ to $+150^{\circ}\text{C}.$ or $-40^{\circ}\text{F}.$ to $+300^{\circ}\text{F}.$ with 24-hour or 7-day chart drive. (Please specify range and chart drive desired.)

REFRIGERATION COMPRESSOR SWITCH

PILOT LIGHTS

AUTOMATIC ELECTRONIC WATER LEVELER

MAIN CIRCUIT BREAKER

VOLTMETERS

REFRIGERATION PRESSURE GAUGES

ELAPSED TIME METER

MAX-SET™ OVERTEMPERATURE PROTECTION

CONSTRUCTION

HOUSING—heli-arc welded, all polished stainless.

INTERIOR—type 316, 17-12 stainless. Heli-arc welded and passivated. Electropolished parts.

HARDWARE—exclusive adjustable no-slam cam action latch and chrome-plated hinges.

EXTERIOR—polished type 304, 18-8 stainless. Removable front and back panels of expanded steel and finished to match control console.

DUAL INSULATION—Thurane and Fiberglas.

DOORS—same construction as cabinet. Two doors but no center mullion. Silicone rubber seal.

INNER GLASS DOOR—stainless framing, latches and fittings. Heavy plate tempered glass; viewing area approximately chamber I.D.

SHELVES—two, adjustable every 2". Electropolished stainless, wire type.

CONSOLE INSTRUMENT CABINET—heavy gauge cold rolled steel, houses reactors, controls, recorder, etc. Attractive blue enamel finish.

MECHANICAL REFRIGERATION—water-cooled system, non-cycling-constant operation. Copeland semi-hermetic, industrial type using Refrigerant 502. High quality with full rated capacity.

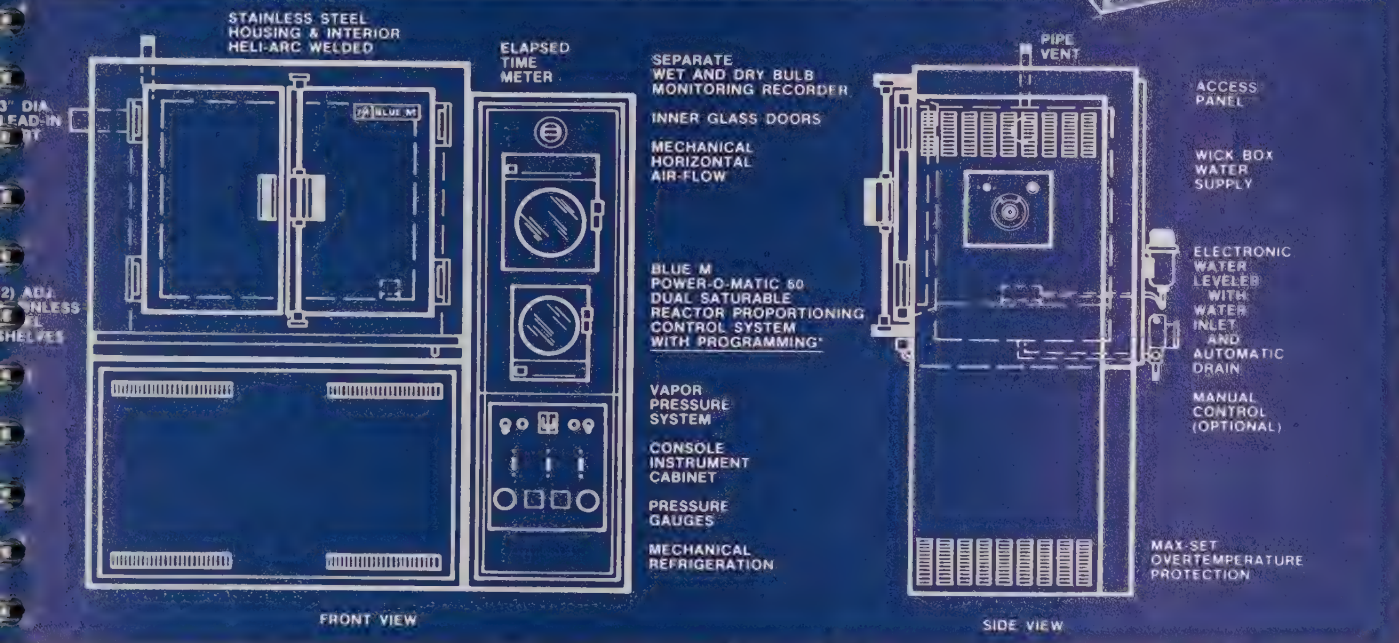
VAPOR PRESSURE SYSTEM—in lieu of atomizing spray. **No wet bulb control wicks to change.**

EQUIPMENT COVERED BY
OUR
EXCLUSIVE
PARTS
WARRANTY
and
REPLACEMENT
SERVICE
PROGRAM



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WATER FLOW AND LEVEL SYSTEM—quality “Y” type strainer, pressure regulator valve, flow control solenoid valves and electronic water leveler to meter water exactly on long-term basis. Unique stainless gravity water leveler accurately and visibly provides required level; overflow outlet. No needle or float valves. Nominal water use.

WET BULB RECORDER WICK CONTAINER—½ gallon bottle in stainless rack. Gravity feed provides wick with distilled water.

OPERATION

Turn on cam drive. In controlling relative humidity, specific water reservoir dew point temperature is maintained by continuously operating submerged cooling coil and wet bulb heating element. The exact temperature is maintained by the wet bulb control bulb which senses water temperature and meters proper voltage to the heaters through the wet bulb POWER-O-MATIC 60 Control System.

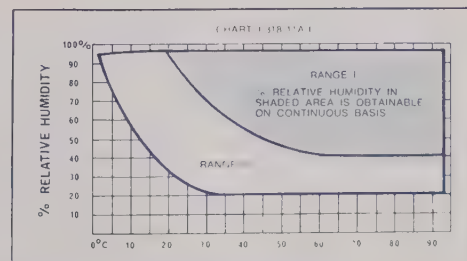
In controlling chamber temperature, air, withdrawn from chamber by blower wheel, is propelled across water surface for chilling and saturation to proper dew point temperature. It then passes over dry bulb heaters, is heated to set dry bulb temperature, and discharged into working area. Heaters are controlled by the dry bulb POWER-O-MATIC 60 Control System. Temperature and humidity are controlled, sensed and recorded by separate instrument in accordance with the program outlined on the cam to meet any condition shown on chart.

***NOTE:** IN ADDITION TO DUAL PROGRAMMED CONTROLS, AUXILIARY WET AND DRY BULB CONTROLS AND TOGGLE SWITCH ARE OPTIONALLY AVAILABLE TO PERMIT MANUAL OPERATION WITHOUT CAMS.

NOTE: Continuous operation at dew point conditions of 3°C. or lower will produce icing of water reservoirs.

Continuous suction line cooling of return hot gas permits continuous operation at +93°C. without compressor damage.

RANGE I:
STANDARD M.L. STD. RANGE
RANGE II
PROGRAMS QUOTED TO ORDER



GENERAL SPECIFICATIONS

Model Number	Inside Dimensions Inches (Cm.)			Overall Dimensions Inches (Cm.)			Total KVA	Voltage 60 Hz. A.C.	Cubic Feet Cap.
	W.	D.	H.	W.	D.	H.			
LR-386PC-1	37 (93)	20 (51)	26 (65)	80 (203)	38 (95)	74 (187)	12.5	240V./1 Ph	11.0

Unit also available for 208 V./1 Ph. and 480 V./1 Ph.

All wiring complete and enclosed to meet N.E. Code, as amended.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: EXTRA CHARTS, EXTRA SHELVES, ELECTRICAL TERMINALS, LEAD-IN PORTS, CRYSTAL-CLEAR WATER PURIFICATION SYSTEM, EXTRA DEMINERALIZING CARTRIDGES, INTERIOR LIGHT AND SWITCH, NEOPRENE RUBBER GLOVES AND/OR PORTS/PLUGS FOR INNER GLASS DOOR, LOCKING CASTERS, LEVELING LEGS, HUMID-PAC ACCESSORY KIT, AND MANUAL CONTROLS.

SEND FOR ADDITIONAL INFORMATION AND ALL PRICES

BLUE M EQUIPMENT

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California, Sunnyvale 94086
Florida, Orlando 32789
Georgia, Atlanta 30341

Illinois, Blue Island 60406
Massachusetts, Framingham 01701
Michigan, Allen Park 48101
New York, Elmsford 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

APPLICATION:

How to reliably test/process to critical standards under conditions of unusually high temperature and humidity.

OPERATING AND CONTROL CHARACTERISTICS

TEMPERATURE RANGE

3° C. above ambient to +150° C.
(+302° F.)

RELATIVE HUMIDITY RANGE

See Chart I-1005-21.

ACCURACY

Temperature: $\pm 1.0^{\circ}$ C.

Relative Humidity: $\pm 1\%$ (80-90%)
 $\pm 3\%$ (Below 80%)

BLUE M GUARANTEE

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operating requirements.

SOLUTION:

BLUE M STEADY STATE CONSTANT HIGH TEMPERATURE/HUMIDITY CABINETS

with Dual Wet and Dry Bulb **POWER-O-MATIC 60**® Saturable Reactor Control Systems, Separate Monitoring Recorder, and Built-In Overtemperature Protection.

This new series of Blue M Temperature/Humidity Cabinets offers industry a unique "self-cleaning" design which eliminates the build-up of corrosive contaminants in the work chamber. Utilizing a one-pass air-flow system which almost literally sweeps the chamber clean, the units provide extremely reliable operation with large volume high temperature, high humidity capabilities. The chambers are ideal for such applications as processing silicone rubber compounds and other products requiring a high moisture content for thorough, rapid curing. They are also being used to test both rigid and flexible methanes. In all such cases, the one-pass air-flow system prevents the fume and contaminant build-up inherent in conventional sealed-chamber designs.

In addition, the one-pass air-flow system serves as an efficient coolant, eliminating compressors—and attendant high compressor wear when chambers operate continuously at high temperatures. These units also provide a much wider humidity range when operating at these elevated temperatures.

GENERAL SPECIFICATIONS

CONTROL SYSTEM

POWER-O-MATIC 60 Dual Saturable Reactor Proportioning Control Systems.

SEPARATE MONITORING RECORDER—2-pen, wet and dry bulb. Accuracy $\pm 1\%$ of scale. Not connected electrically or mechanically to control system. Monitors and provides records only. 100 - 12" diameter charts, pens and all accessories included. Ranges: -50° C. to $+150^{\circ}$ C. or -60° F. to $+300^{\circ}$ F. with 24-hour or 7-day chart drive. (Please specify range and chart drive desired.)

PILOT LIGHTS

AUTOMATIC ELECTRONIC WATER LEVELER

MAIN CIRCUIT BREAKER

VOLTMETERS

ELAPSED TIME METER

MAX-SET™ OVERTEMPERATURE PROTECTION

CONSTRUCTION

HOUSING—heli-arc welded, all polished stainless.

INTERIOR—type 316, 17-12 stainless. Heli-arc welded and passivated. Electropolished parts.

HARDWARE—exclusive adjustable no-slam cam action latch and chrome-plated hinges.

EXTERIOR—polished type 304, 18-8 stainless. Removable front and back panels of expanded steel and finished to match control console.

DOOR(S)—same construction and insulation as cabinet. 11, 27 and 64 cubic-foot models have two doors but no center mullion. Silicone seal(s).

INNER STAINLESS DOOR—stainless latches. Helps maintain desired chamber environment.

SHELVES—two, adjustable every 2". Electropolished stainless, wire type.

CONSOLE INSTRUMENT CABINET—heavy gauge cold rolled steel, houses reactors, controls, recorder, etc. Attractive blue enamel finish.

ADJUSTABLE ONE-PASS AIR-FLOW SYSTEM—conditioned air passes over water surface and heaters through chamber only once if necessary. Permits 100% exhaust. Quality air circulation system includes stainless steel blower wheel. Air flow rates fully adjustable.

VAPOR PRESSURE SYSTEM—quality "Y" type strainer, pressure regulator valve, flow control solenoid valves and electronic water leveler to

EQUIPMENT COVERED BY

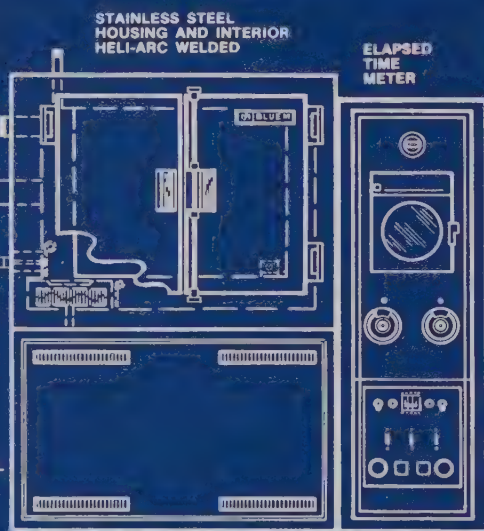
OUR EXCLUSIVE

PARTS
WARRANTY
and
REPLACEMENT
SERVICE
PROGRAM



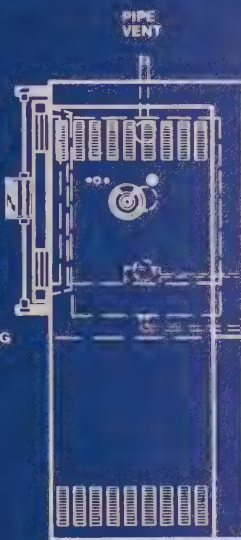
A BLUE M

STANDARD



FRONT VIEW

SEPARATE WET AND DRY BULB MONITORING RECORDER
INNER STAINLESS DOOR
MECHANICAL HORIZONTAL AIR-FLOW
BLUE M POWER-O-MATIC 60 DUAL SATURABLE REACTOR PROPORTIONING CONTROL SYSTEM AND MAX-SET OVERTEMPERATURE PROTECTION
VAPOR PRESSURE SYSTEM
CONSOLE INSTRUMENT CABINET



SIDE VIEW

TWO ADJUSTABLE STAINLESS SHELVES
WICK BOX WATER SUPPLY
ELECTRONIC WATER LEVELER WITH WATER INLET AND AUTOMATIC DRAIN

meter water exactly on long-term basis. Unique stainless gravity water leveler accurately and visibly provides required level; overflow outlet. No needle or float valves. Nominal water use.

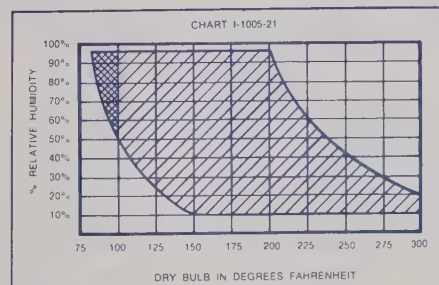
WET BULB RECORDER WICK CONTAINER— $\frac{1}{2}$ gallon bottle in stainless rack. Gravity feed provides wick with distilled water.

OPERATION

Set controls for desired operating conditions. In controlling relative humidity, specific water reservoir dew point temperature is maintained by continuously operating submerged cooling coil and wet bulb heating element. The exact temperature is maintained by the wet bulb control bulb which senses water temperature and meters proper voltage to the heaters through the wet bulb POWER-O-MATIC 60 Control System.

In controlling chamber temperature, air, withdrawn from chamber by stainless blower wheel, is propelled across water surface for chilling and saturation to proper dew point temperature. It then passes over dry bulb heaters, is heated to set dry bulb temperature, and discharged into working area. Heaters are controlled by the dry bulb POWER-O-MATIC 60 Control System. Temperature and humidity are controlled, sensed and recorded by separate instrument in accordance with control and adjustable air-flow settings to meet any condition shown on chart.

Cross-hatched area is a variable depending upon ambient temperature. Reliable control is obtained at 5°F. above ambient. Right-hand curve represents maximum R.H. obtainable at atmospheric pressure at temperatures above +200°F. and corresponds with a constant dew point of approximately +205°F. Approximate water consumption at a condition of +200°F., 98% R.H. and minimum exhaust setting is 1 Gal./Hour. Chart based on ambient air at +85°F., 50% R.H.



GENERAL SPECIFICATIONS

Model Number	Inside Dimensions Inches (Cm.)			Overall Dimensions Inches (Cm.)			Total KVA	Voltage 60 Hz. A.C.	Cubic Feet Cap.
	W.	D.	H.	W.	D.	H.			
HR-251C	25 (63)	20 (51)	21 (53)	72 (183)	38 (95)	70 (177)	7.5	*240V/1 Ph.	6.0
HR-381C	37 (93)	20 (51)	26 (65)	84 (213)	38 (95)	75 (190)	11.8	*240V/1 Ph.	11.0
HR-361C	36 (90)	36 (90)	36 (90)	83 (211)	54 (136)	79 (200)	16.8	*240V/1 Ph.	27.0
HR-441F	48 (120)	48 (120)	48 (120)	93 (236)	66 (167)	89 (226)	28.9	240V/3 Ph.	64.0

*Unit also available for 208V/1 Ph.

All wiring complete and enclosed to meet N.E. Code, as amended.

OPTIONAL ACCESSORIES INCLUDE: EXTRA CHARTS, SHELVES, ELECTRICAL TERMINALS, LEAD-IN PORTS, CRYSTAL-CLEAR WATER PURIFICATION SYSTEM, EXTRA DEMINERALIZING CARTRIDGES, HUMID-PAC ACCESSORY KIT, LOCKING CASTERS, AND LEVELING LEGS.

SEND FOR ADDITIONAL INFORMATION AND ALL PRICES

BLUE M EQUIPMENT

A SALES AND SERVICE BRANCH OF
BLUE M EQUIPMENT COMPANY
Corporate Headquarters: Blue Island, Illinois 60406

Arizona, Scottsdale 85251
California, El Monte 91731
California, Sunnyvale 94086
Florida, Orlando 32789
Georgia, Atlanta 30341

Illinois, Blue Island 60406
Massachusetts, Framingham 01701
Michigan, Allen Park 48101
New York, Elmsford 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

**BLUE M**engineered
products in**ACTION****OPERATING AND CONTROL CHARACTERISTICS****TEMPERATURE RANGE**

-18°C. to +93°C. (+200°F.)

RELATIVE HUMIDITY RANGE

See Chart I-318-11A-1.

STABILIZATION TIME

+25°C. to +93°C.: 1 hour (approx.)

+93°C. to +25°C.: 1 hour (approx.)

+25°C. to -10°C.: 25 minutes (approx.)

STABILITY

(Over 24 hr. period)

Temperature: $\pm \frac{1}{2}$ °C.Relative Humidity: $\pm \frac{1}{2}$ %.**RECOVERY TIME**

Average recovery of stabilized temperature and relative humidity when door is opened 5 minutes or less: 25 minutes at +65°C.

DUTY RATING

Continuous.

Meets MIL-202D, Method 103B including Condition D—continuous operation for 1344 hours . . . 56 days!

APPLICATION:

How to reproduce a wide range of single steady state conditions over prolonged periods with complete accuracy, reliability and stability.

SOLUTION:**BLUE M FULL RANGE SINGLE STEADY STATE CONSTANT TEMPERATURE/HUMIDITY CABINETS**with Dual Wet and Dry Bulb **POWER-O-MATIC-60**® Saturable Reactor

Control Systems and Separate Monitoring Recorder.

Blue M Mechanical Convection Horizontal Air-Flow Single Steady State Temperature/Humidity Cabinets are easily the most reliable and accurate means of reproducing single steady state conditions available today. Featuring dual wet and dry bulb POWER-O-MATIC 60 Saturable Reactor Non-Cycling Control Systems and separate monitoring recorder, they are priced competitively with other units utilizing on-off controls and integral recording. They are unconditionally recommended where programming is not required for any condition shown on the chart.

Included among their many outstanding features is a heavy-duty, large capacity industrial type compressor which assures rapid pull down and maintains close temperature and humidity tolerances under conditions of high load power dissipation. High volume blower system assures maximum temperature and humidity range. Horizontal air-flow permits maximum loading of chamber interior. These features plus high speed stabilization and the finest control tolerances available at this time results in a quality cabinet which is recommended without qualification for any application where maximum capabilities are required. Overtemperature protection, now standard, safeguards workload and equipment.

GENERAL SPECIFICATIONS**CONTROL SYSTEM****POWER-O-MATIC 60** Dual Saturable Reactor Proportioning Control Systems.

SEPARATE MONITORING RECORDER—2 pen, wet and dry bulb, 24 hour chart drive. Range: -18°C. to +93°C. Accuracy $\pm 1\%$ of scale. Calibrated at +65°C., $\pm \frac{1}{2}$ °C. Not connected electrically or mechanically to control system. Monitors and provides records only. 100-12" diameter charts, pens and all accessories included.

REFRIGERATION COMPRESSOR SWITCH • PILOT LIGHTS • AUTOMATIC ELECTRONIC WATER LEVELER • MAIN CIRCUIT BREAKER • VOLT-METERS • REFRIGERATION PRESSURE GAUGES • ELAPSED TIME METER • MAX-SET™ OVER-TEMPERATURE PROTECTION

CONSTRUCTION**HOUSING**—heli-arc welded, all polished stainless.**INTERIOR**—type 316, 17-12 stainless. Heli-arc welded and passivated. Electropolished parts.

EXTERIOR—polished type 304, 18-8 stainless. Removable front and back panels of expanded steel and finished to match control console.

INSULATION—Fiberglas.**HARDWARE**—exclusive adjustable no-slam, cam action latch and chrome-plated hinges.

DOOR(S)—same construction and insulation as cabinet. 11, 27 and 64 cubic foot models have double doors, no center mullion. Silicone seal(s).

INNER GLASS DOOR—stainless framing, latches and fittings. Heavy plate tempered glass viewing area approximately chamber I.D. Silicone seals.

SHELVES—two, adjustable every 2". Electropolished stainless, wire type.

CONSOLE INSTRUMENT CABINET—heavy gauge cold rolled steel, houses reactors, controls, recorder, etc. Attractive blue enamel finish.

MECHANICAL REFRIGERATION—dual cooling system, non-cycling—constant operation. Copeland semi-hermetic, industrial type using Refrigerant 12. High quality with full rated capacity.

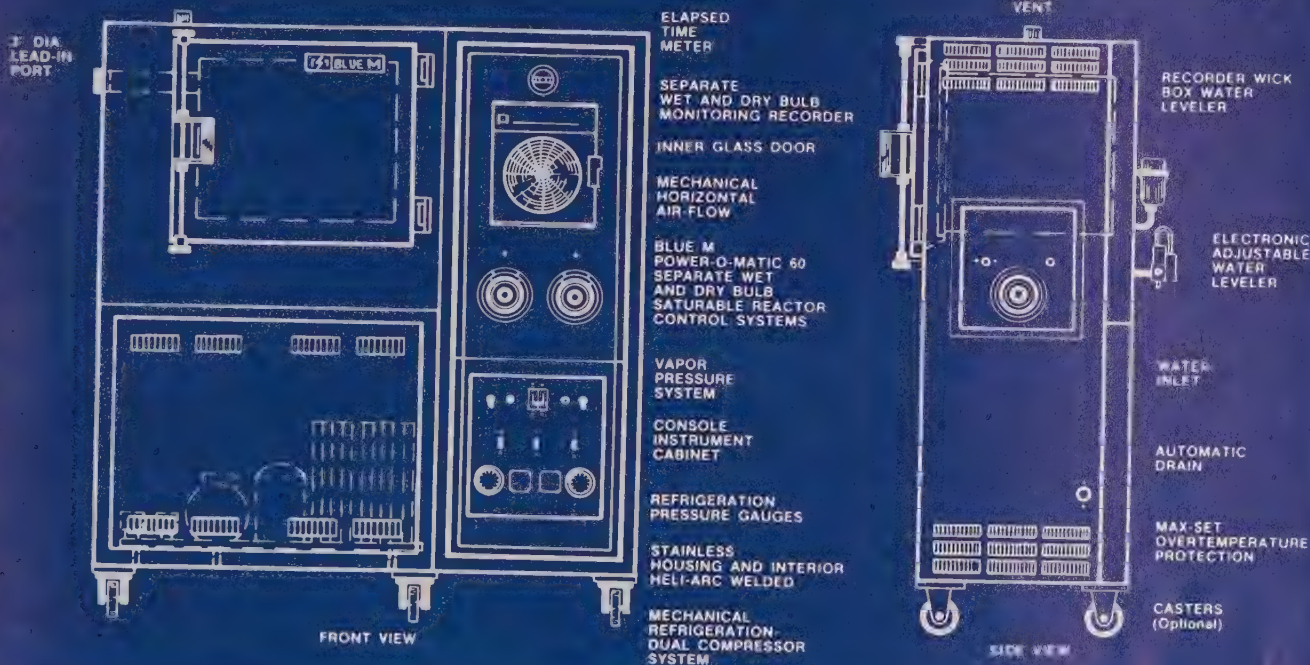
VAPOR PRESSURE SYSTEM—in lieu of atomizing spray. **No wet bulb control wicks to change.**

WATER FLOW AND LEVEL SYSTEM—quality "Y" type strainer, pressure regulator valve, flow control solenoid valves and electronic water leveler to meter water exactly on long-term basis. Unique

EQUIPMENT COVERED BY
OUR
EXCLUSIVEPARTS
WARRANTY
and
REPLACEMENT
SERVICE
PROGRAM**BLUE M**

A BLUE M

STANDARD



stainless gravity water leveler accurately and visibly provides required level; overflow outlet. No needle or float valves. Nominal water use.

WET BULB RECORDER WICK CONTAINER— $\frac{1}{2}$ gallon bottle in stainless rack. Gravity feed provides wick with distilled water.

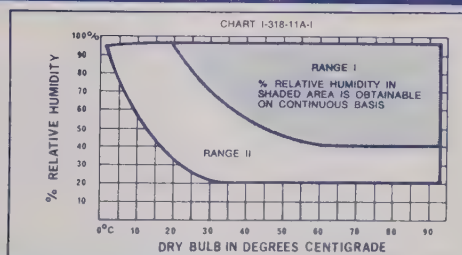
OPERATION

Set controls for desired operating conditions. In controlling relative humidity, specific water reservoir dew point temperature is maintained by continuously operating submerged cooling coil and wet bulb heating element. The exact temperature is maintained by the wet bulb control bulb which senses water temperature and meters proper voltage to the heaters through the wet bulb POWER-O-MATIC 60 Control System.

In controlling chamber temperature, air, withdrawn from chamber by blower wheel, is propelled across water surface for chilling and saturation to proper dew point temperature. It then passes over dry bulb heaters, is heated to set dry bulb temperature, and discharged into working area. Heaters are controlled by the dry bulb POWER-O-MATIC 60 Control System. Temperature and humidity are controlled, sensed and recorded by separate instrument to meet any condition shown on chart.

NOTE: Continuous operation at dew point conditions of 3°C . or lower will produce icing of water reservoirs.

Continuous suction line cooling of return hot gas permits continuous operation at $+93^{\circ}\text{C}$. without compressor damage.



GENERAL SPECIFICATIONS

Model Number	Inside Dimensions Inches (Cm.)			*Overall Dimensions Inches (Cm.)			Total KVA	Voltage 60 Hz. A.C.	Cubic Feet Cap.
	W.	D.	H.	W.	D.	H.			
FR-251C-1	25 (63)	20 (51)	21 (53)	68 (172)	38 (95)	70 (177)	10.8	240 V./1 Ph	6.0
FR-381C-1	37 (93)	20 (51)	26 (65)	80 (203)	38 (95)	74 (187)	14.4	240 V./1 Ph	11.0
FR-361C-1	36 (90)	36 (90)	36 (90)	79 (200)	54 (136)	79 (200)	19.2	240 V./1 Ph	27.0
FR-441F-2	48 (120)	48 (120)	48 (120)	99 (251)	65 (165)	89 (226)	31.5	240 V./3 Ph	64.0

*Overall dimension width includes 25" wide console control cabinet. All wiring complete and enclosed to meet N.E. Code, as amended.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: EXTRA CHARTS, EXTRA SHELVES, ELECTRICAL TERMINALS, LEAD-IN PORTS, CRYSTAL-CLEAR WATER PURIFICATION SYSTEM, EXTRA DEMINERALIZING CARTRIDGES, INTERIOR LIGHT AND SWITCH, NEOPRENE RUBBER GLOVES AND/OR PORTS/PLUGS FOR INNER GLASS DOOR, LOCKING CASTERS, HUMID-PAC ACCESSORY KIT, AND LEVELING LEGS.

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New York, Elmsford 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

**BLUE M**engineered
products in**ACTION****OPERATING AND CONTROL
CHARACTERISTICS****TEMPERATURE RANGE**
+3°C. to +93°C. (+200°F.)**RELATIVE HUMIDITY RANGE**
See Chart I-478-8**STABILIZATION TIME**
+25°C. to +93°C.: 1½ hours
(approx.)
+93°C. to +25°C.: 2½ hours
(approx. Cam angle limitation)**STABILITY**
(Over 24 hr. period, steady state)
Temperature: $\pm\frac{3}{4}^{\circ}\text{C}$.
Relative Humidity: $\pm 1\%$.**RECOVERY TIME**
Average recovery of stabilized temperature and relative humidity when door is opened 5 minutes or less: 45 minutes at +65°C.**DUTY RATING**
Continuous.Meets MIL-202D, Method 106C,
Steps 1-7, excluding -10°C. dip.**APPLICATION:**

How to reproduce many MIL test specifications with programming and recording at or above +25°C. with relative humidity at 90% or above with excellent stability, reliability and accuracy.

SOLUTION:**BLUE M MECHANICAL REFRIGERATION
TEMPERATURE/HUMIDITY CABINETS**with Dual Wet and Dry Bulb **POWER-O-MATIC 60**® Saturable Reactor
Control Systems, Programming, and Separate Monitoring Recorder.

These limited range Mechanical Convection, Vertical Air-Flow Cabinets are especially designed to economically perform any current MIL humidity test which is conducted at +25°C. or above with R.H. at 90% or above. Although the vertical air-flow design somewhat limits loading, and construction is more economical than Blue M Full Range Temperature/Humidity Cabinets, these units provide excellent stability, reliability and accuracy within range shown on chart.

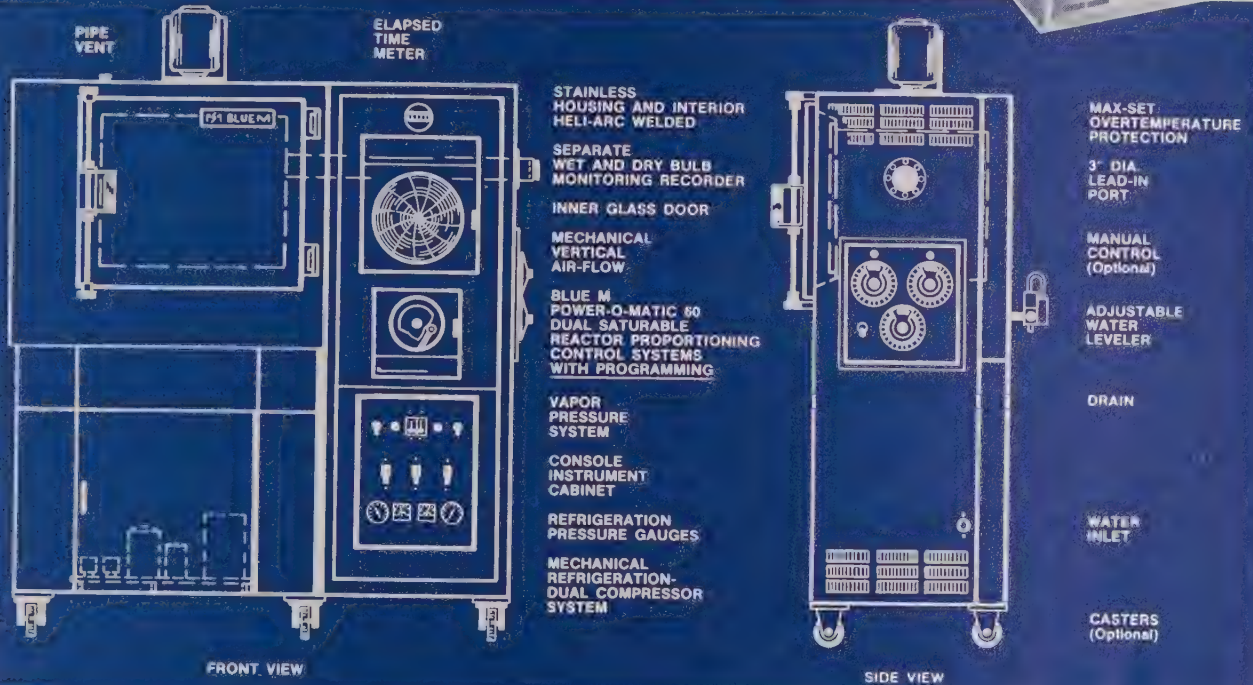
These units are recommended for continuous duty testing of small parts where a separate cold chamber has been used to perform the sub-ambient portions of a programmed cycle, and 100% of the use of the cabinet will be performing the popular MIL specs. A built-in, self-contained refrigeration system with a high quality hermetic compressor provides ample constant cooling capacity to reach any temperature from ambient down to +3°C., and avoids the use of tap water cooling, a drawback in certain areas of the country. Overtemperature protection, now standard, safeguards workload and equipment.

Similar units without programming for reproducing single steady state conditions are described elsewhere in this section.

GENERAL SPECIFICATIONS**CONTROL SYSTEM****POWER-O-MATIC 60** Dual Saturable Reactor Proportioning Control Systems with programming.**SEPARATE MONITORING RECORDER**—2 pen, wet and dry bulb, 24 hour chart drive. Range to suit cabinet. Not connected electrically or mechanically to control system. Monitors and provides records only. 100-12" diameter charts, pens and all accessories included. Set of cams—blank or cut to your program—also supplied.**MAX-SET™ OVERTEMPERATURE PROTECTION**
REFRIGERATION COMPRESSOR SWITCH
REFRIGERATION PRESSURE GAUGES
AUTOMATIC ELECTRONIC WATER LEVELER
ELAPSED TIME METER
VOLTMETERS
MAIN CIRCUIT BREAKER
PILOT LIGHTS**CONSTRUCTION****HOUSING**—heli-arc welded, all polished stainless.**INTERIOR**—type 316, 17-12 stainless. Heli-arc welded; passivated. Removable parts electropolished.**EXTERIOR**—polished type 304, 18-8 stainless. Removable front and back panels of expanded steel and finished to match control console.**INSULATION**—Fiberglas.**HARDWARE**—exclusive adjustable no-slam, cam action latch and chrome-plated hinges.**DOOR(S)**—same construction and insulation as cabinet. Largest unit has two doors but no center mullion. Silicone rubber seal.**INNER GLASS DOOR**—stainless framing, latches and fittings. Heavy plate tempered glass viewing area approximates chamber I.D. Silicone seals.**SHELVES**—two, adjustable every 2". Electropolished stainless, wire type.**CONSOLE INSTRUMENT CABINET**—heavy gauge cold rolled steel, houses reactors, controls, recorder, etc. Attractive blue enamel finish.**MECHANICAL REFRIGERATION**—dual cooling system, non-cycling. Copeland hermetic type using Refrigerant 12. Ample capacity for cabinet.**VAPOR PRESSURE SYSTEM**—in lieu of atomizing spray. No wet bulb control wicks to change.**WATER FLOW AND LEVEL SYSTEM**—quality "Y" type strainer, pressure regulator valve, flow control solenoid valves and electronic water leveler to meter water exactly on long-term basis. Unique stainless gravity water leveler accurately and**EQUIPMENT COVERED BY
OUR
EXCLUSIVE**PARTS
WARRANTY
and
REPLACEMENT
SERVICE
PROGRAM**BLUE M**

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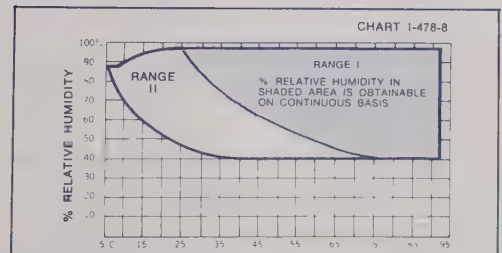
visibly provides required level; overflow outlet. No needle or float valves. Nominal water use.

WET BULB RECORDER WICK CONTAINER—½ gallon bottle in stainless rack. Gravity feed provides wick with distilled water.

DRY BULB TEMPERATURE
(DEGREES CENTIGRADE)

RANGE I
STANDARD MIL. STD. RANGE
RANGE II
PROGRAMS QUOTED TO
ORDER

NOTE: Control of $\pm \frac{1}{2}^{\circ}\text{C}$. and $\pm 1\%$ R.H. in Range I; Control of $\pm 1^{\circ}\text{C}$ and $\pm 2\%$ R.H. in Range II



OPERATION

Turn on cam drive. In controlling relative humidity, specific water reservoir dew point temperature is maintained by continuously operating submerged cooling coil and wet bulb heating element. The exact temperature is maintained by the wet bulb control bulb which senses water temperature and meters proper voltage to the heaters through the wet bulb POWER-O-MATIC 60 Control System.

In controlling chamber temperature, air, withdrawn from chamber by blower wheel, is propelled across water surface for chilling and saturation to proper dew point temperature. It then passes over dry bulb heaters, is heated to set dry bulb temperature, and discharged into working area. Heaters are controlled by the dry bulb POWER-O-MATIC 60 Control System. Temperature and humidity are controlled, sensed and recorded by separate instrument in accordance with the program outlined on the cam to meet any condition shown on chart.

Model Number	Inside Dimensions Inches (Cm.)			*Overall Dimensions Inches (Cm.)			Total KVA	Voltage 60 Hz. A.C.	Cubic Feet Cap.
	W.	D.	H.	W.	D.	H.			
CPR-7502C	20 (51)	14 (35)	20 (51)	63 (159)	34 (86)	81 (205)	5.8	240 V./1 Ph.	3.2
CPR-7602C	25 (63)	19 (48)	20 (51)	68 (172)	39 (98)	81 (205)	5.8	240 V./1 Ph.	5.5
CPR-7702C	37 (93)	19 (48)	25 (63)	80 (203)	39 (98)	81 (205)	6.6	240 V./1 Ph.	10.0

*Overall dimension width includes 25" wide console control cabinet.
All wiring complete and enclosed to meet N.E. Code, as amended.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: EXTRA CHARTS, EXTRA SHELVES, ELECTRICAL TERMINALS, LEAD-IN PORTS, CRYSTAL-CLEAR WATER PURIFICATION SYSTEM, EXTRA DEMINERALIZING CARTRIDGES, INTERIOR LIGHT AND SWITCH, NEOPRENE RUBBER GLOVES AND/OR PORTS/PLUGS FOR INNER GLASS DOOR, CASTERS, LEVELING LEGS, HUMID-PAC ACCESSORY KIT, AND MANUAL CONTROLS.

SEND FOR ADDITIONAL INFORMATION AND ALL PRICES

BLUE M EQUIPMENT

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BLUE M EQUIPMENT COMPANY
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California, Sunnyvale 94086
Florida, Orlando 32789
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New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

**BLUE M**engineered
products in**ACTION****APPLICATION:**

How to perform a wide variety of single steady state tests within a limited temperature/humidity range when excellent stability, reliability and accuracy are required.

OPERATING AND CONTROL CHARACTERISTICS**TEMPERATURE RANGE**

+3°C. to +93°C. (+200°F.)

RELATIVE HUMIDITY RANGE

See Chart I-478-8.

STABILIZATION TIME

+25°C. to +93°C.: 1½ hours (approx.)

+93°C. to +25°C.: 1½ hours (approx.)

STABILITY

(Over 24 hr. period)

Temperature: $\pm\frac{1}{4}$ °C.

Relative Humidity: $\pm 1\%$.

RECOVERY TIME

Average recovery of stabilized temperature and relative humidity when door is opened 5 minutes or less: 45 minutes at +65°C.

DUTY RATING

Continuous.

Meets MIL-202D, Method 103B including Condition D — continuous operation for 1344 hours . . . 56 days!

SOLUTION:**BLUE M SINGLE STEADY STATE TEMPERATURE/HUMIDITY CABINETS**

with Dual Wet and Dry Bulb **POWER-O-MATIC 60**® Saturable Reactor Control Systems and Separate Monitoring Recorder.

These Mechanical Convection, Vertical Air-Flow Cabinets meet all the requirements for stable, reliable and accurate steady state testing within the range shown in the chart on the opposite page. They are recommended for continuous duty testing of small, low volume components which do not dissipate any substantial amounts of heat, for steady state MIL tests, paint sample testing, and water vapor transmission.

In keeping with their restricted service requirements, these units feature relatively inexpensive construction, low K.W. rating, and a low volume blower system—features which do not hinder their efficiency within their limited range, but which keep their cost low. They also feature a built-in, self-contained refrigeration system for sub-ambient testing which avoids the use of tap water cooling, a drawback in certain areas of the country.

Similar units with POWER-O-MATIC 60 cam-type programming are described elsewhere in this section.

GENERAL SPECIFICATIONS**CONTROL SYSTEM**

POWER-O-MATIC 60 Dual Saturable Reactor Proportioning Control System.

MAX-SET™ OVERTEMPERATURE PROTECTION

SEPARATE MONITORING RECORDER—2 pen, wet and dry bulb, 24 hour chart drive. Range to suit cabinet. Not connected electrically or mechanically to control system. Monitors and provides records only. 100-12" diameter charts, pens and all accessories included. Mounted on hinged door on side of unit.

REFRIGERATION COMPRESSOR SWITCH**REFRIGERATION PRESSURE GAUGES****AUTOMATIC ELECTRONIC WATER LEVELER****ELAPSED TIME METER****VOLTMETERS****MAIN SWITCH****PILOT LIGHTS****CONSTRUCTION**

HOUSING—heli-arc welded, all polished stainless.

INTERIOR—type 316, 17-12 stainless. Heli-arc welded and passivated. Electropolished parts.

EXTERIOR—polished type 304, 18-8 stainless.

INSULATION—Fiberglas.

HARDWARE—exclusive adjustable no-slam, cam action latch and chrome-plated hinges.

DOOR(S)—same construction and insulation as cabinet. Largest unit has two doors but no center mullion. Silicone rubber seal.

INNER GLASS DOOR—stainless framing, latches and fittings. heavy plate tempered glass viewing area approximates chamber I.D. Silicone seal(s).

SHELVES—two, adjustable every 2". Electropolished stainless, wire type.

CABINET FLOOR STAND—heavy gauge cold rolled steel. Attractive blue finish. Houses mechanical refrigeration system.

MECHANICAL REFRIGERATION—dual cooling system, non-cycling. Copeland hermetic type using Refrigerant 12. Ample capacity for cabinet.

VAPOR PRESSURE SYSTEM—in lieu of atomizing spray. No wet bulb control wicks to change.

WATER FLOW AND LEVEL SYSTEM—quality "Y" type strainer, pressure regulator valve, flow control solenoid valves and electronic water leveler to meter water exactly on long-term basis. Unique

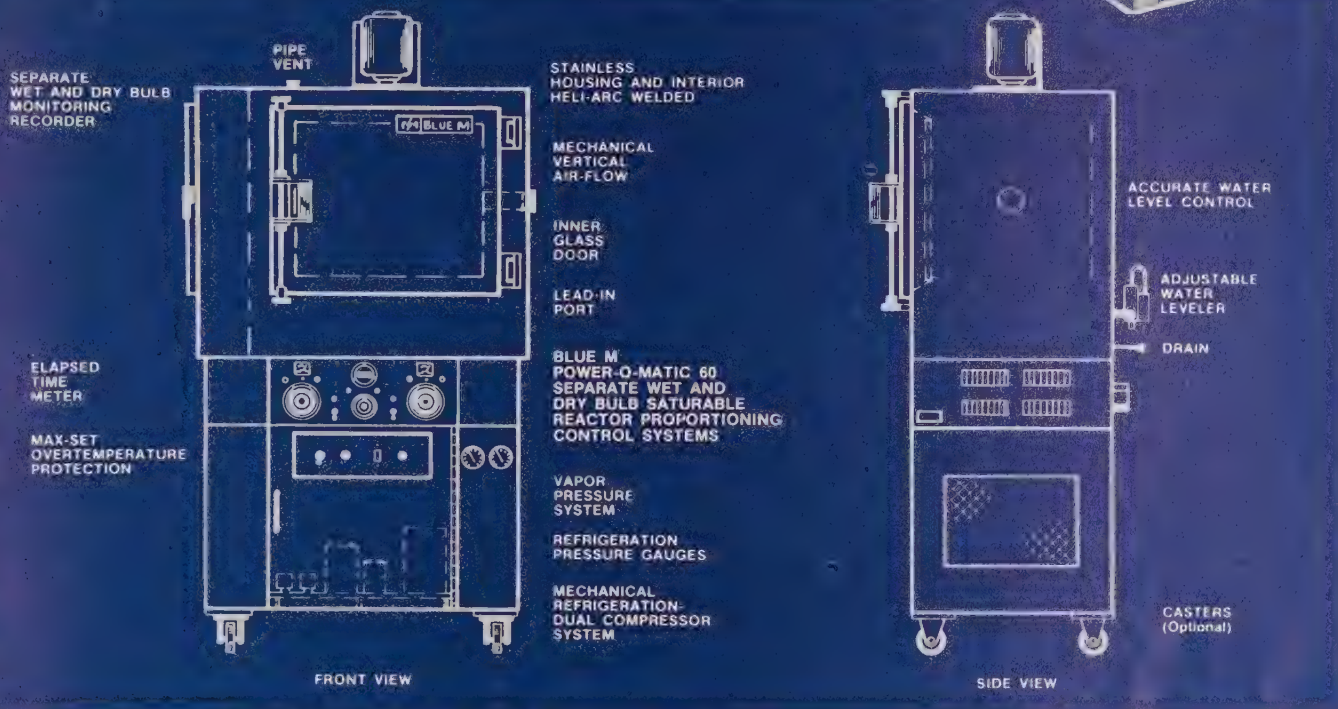
EQUIPMENT COVERED BY
OUR
EXCLUSIVE

PARTS
WARRANTY
and
REPLACEMENT
SERVICE
PROGRAM

**BLUE M**

A BLUE M

STANDARD



stainless gravity water leveler accurately and visibly provides required level; overflow outlet. No needle or float valves. Nominal water use.

WET BULB RECORDER WICK CONTAINER— $\frac{1}{2}$ gallon bottle in stainless rack. Gravity feed provides wick with distilled water.

LEAD-IN PORT

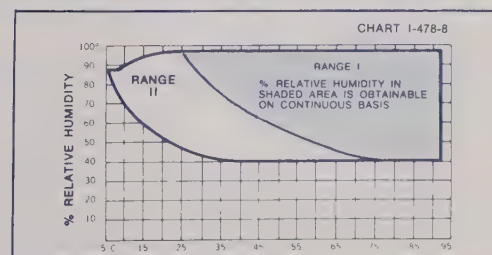
OPERATION

Set controls for desired operating conditions. In controlling relative humidity, specific water reservoir dew point temperature is maintained by continuously operating submerged cooling coil and wet bulb heating element. The exact temperature is maintained by the wet bulb control bulb which senses water temperature and meters proper voltage to the heaters through the wet bulb POWER-O-MATIC 60 Control System.

In controlling chamber temperature, air, withdrawn from chamber by blower wheel, is propelled across water surface for chilling and saturation to proper dew point temperature. It then passes over dry bulb heaters, is heated to set dry bulb temperature, and discharged into working area. Heaters are controlled by the dry bulb POWER-O-MATIC 60 Control System. Temperature and humidity are controlled, sensed and recorded by separate instrument to meet any condition shown on chart.

DRY BULB TEMPERATURE
(DEGREES CENTIGRADE)

NOTE: Control of $\pm\frac{1}{2}^{\circ}\text{C}$. and $\pm 1\%$ R.H. in Range I; Control of $\pm 1^{\circ}\text{C}$. and $\pm 2\%$ R.H. in Range II.



GENERAL SPECIFICATIONS

Model Number	Inside Dimensions Inches (Cm.)			Overall Dimensions Inches (Cm.)			Total KVA	Voltage 60 Hz. A.C.	Cubic Feet Cap.
	W.	D.	H.	W.	D.	H.			
CFR-7552C	20 (51)	14 (35)	20 (51)	38 (95)	34 (86)	81 (205)	5.8	240 V./1 Ph	3.2
CFR-7652C	25 (63)	19 (48)	20 (51)	43 (109)	39 (98)	81 (205)	5.8	240 V./1 Ph	5.5
CFR-7752C	37 (93)	19 (48)	25 (63)	55 (139)	39 (98)	81 (205)	6.6	240 V./1 Ph	10.0

All wiring complete and enclosed to meet N.E. Code, as amended.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: EXTRA CHARTS, EXTRA SHELVES, ELECTRICAL TERMINALS, LEAD-IN PORTS, CRYSTAL-CLEAR WATER PURIFICATION SYSTEM, EXTRA DEMINERALIZING CARTRIDGES, INTERIOR LIGHT AND SWITCH, NEOPRENE RUBBER GLOVES AND/OR PORTS/PLUGS FOR INNER GLASS DOOR, LOCKING CASTERS, HUMID-PAC ACCESSORY KIT, AND LEVELING LEGS.

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New York, Elmsford 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

APPLICATION: How to accurately and economically duplicate high temperature/humidity conditions to meet strict military and industrial specifications.

OPERATING AND CONTROL CHARACTERISTICS

TEMPERATURE RANGE

12°C. above ambient to +93°C.
(+200°F.)

RELATIVE HUMIDITY RANGE

See Chart 1-443A.

STABILIZATION TIME

+25°C. to +93°C.: 1 hour (approx.)
+93°C. to +25°C.: 1 hour (approx.)

STABILITY

(Over 24 hr. period)
Temperature: $\pm \frac{1}{2}^{\circ}\text{C}$.
Relative Humidity: $\pm \frac{1}{2}\%$.

RECOVERY TIME

Average recovery of stabilized temperature and relative humidity when door is opened 5 minutes or less: 45 minutes at +65°C.

Meets MIL-202D, Method 103B including Condition D — continuous operation for 1344 hours . . . 56 days!

SOLUTION:

BLUE M *Humid-Flow*™ AIR-COOLED TEMPERATURE/HUMIDITY CABINETS

with Dual Wet and Dry Bulb **POWER-O-MATIC 60**® Saturable Reactor Proportioning Control Systems, and Separate Monitoring Recorder.

The most accurate, reliable and economical chamber ever developed for long-term high temperature/humidity testing. Ideal for such steady state requirements as MIL-202D, Method 103B, Condition D—continuous operation for 56 days.

Blue M's exclusive vertical air-flow Air-Cooled Temperature/Humidity Cabinets let air do the work—not costly conditioned water. Typical unit can save thousands of gallons a year. Eliminating compressor and tap water circulating systems eliminates such components as solenoid valves and timers—assures more trouble-free operation. Ambient room air temperature in most installations is more stable than varying tap water temperatures, making chamber conditions equally stable. This, coupled with the inherent reliability of the independent POWER-O-MATIC 60 Control Systems for temperature and humidity, provides unusual accuracy plus built-in constant differential control throughout the range shown on the chart. Air volume is adjustable from 0-30 complete changes of entire work chamber volume per minute.

While this range is limited as compared to other Blue M Temperature/Humidity Cabinets, minimal power requirements and insignificant water consumption sharply reduce operating costs. Specially designed motor/blower cooling system, under control of a separate switch, is not even needed for many standard tests—cutting operating expense even more. In design, operating efficiency and economy, Blue M Air-Cooled Cabinets represent a truly revolutionary development in environmental equipment.

GENERAL SPECIFICATIONS

CONTROL SYSTEM

POWER-O-MATIC 60 Dual Saturable Reactor Proportioning Control Systems.

MAX-SET™ OVERTEMPERATURE PROTECTION

SEPARATE MONITORING RECORDER—12" dia.

Range: -18°C. to +93°C. Calibrated at +65°C., $\pm \frac{1}{2}^{\circ}\text{C}$. Accuracy $\pm 1\%$ of scale. Not connected electrically or mechanically to control system. Monitors and provides records only. Complete with 2 pens, 100 charts and all accessories. 24-hour chart drive standard. 7-day model optional and must be specified.

PILOT LIGHTS • AUTOMATIC ELECTRONIC WATER LEVELER • MAIN CIRCUIT BREAKER • VOLTMETERS • COMPLEMENTARY MOTOR/BLOWER SYSTEMS AND OVERLOAD PROTECTION • ELAPSED TIME METER

CONSTRUCTION

HOUSING—heli-arc welded, all polished stainless.

INTERIOR—type 316, 17-12 stainless. Heli-arc welded and passivated.

EXTERIOR—type 304, 18-8 stainless.

INSULATION—Fiberglas.

HARDWARE—exclusive adjustable no-slam, cam action latch and chrome-plated hinges.

DOOR(S)—same construction and insulation as cabinet. Largest model has double doors but no center mullion. Silicone rubber seal.

INNER GLASS DOOR—stainless framing, SURE-LOCK alloy latches and fittings. Heavy plate tempered glass; viewing area approximates chamber I.D. Silicone rubber seal.

SHELVES—two adjustable every 2". Electropolished stainless, wire type.

WATER FLOW AND LEVEL SYSTEM—quality "Y" type strainer, pressure regulator valve, flow control solenoid valves and electronic water leveler to meter water exactly on long-term basis. Alloy water receptacle permits visual inspection. Overflow outlet. No needle or float valves. Nominal water use.

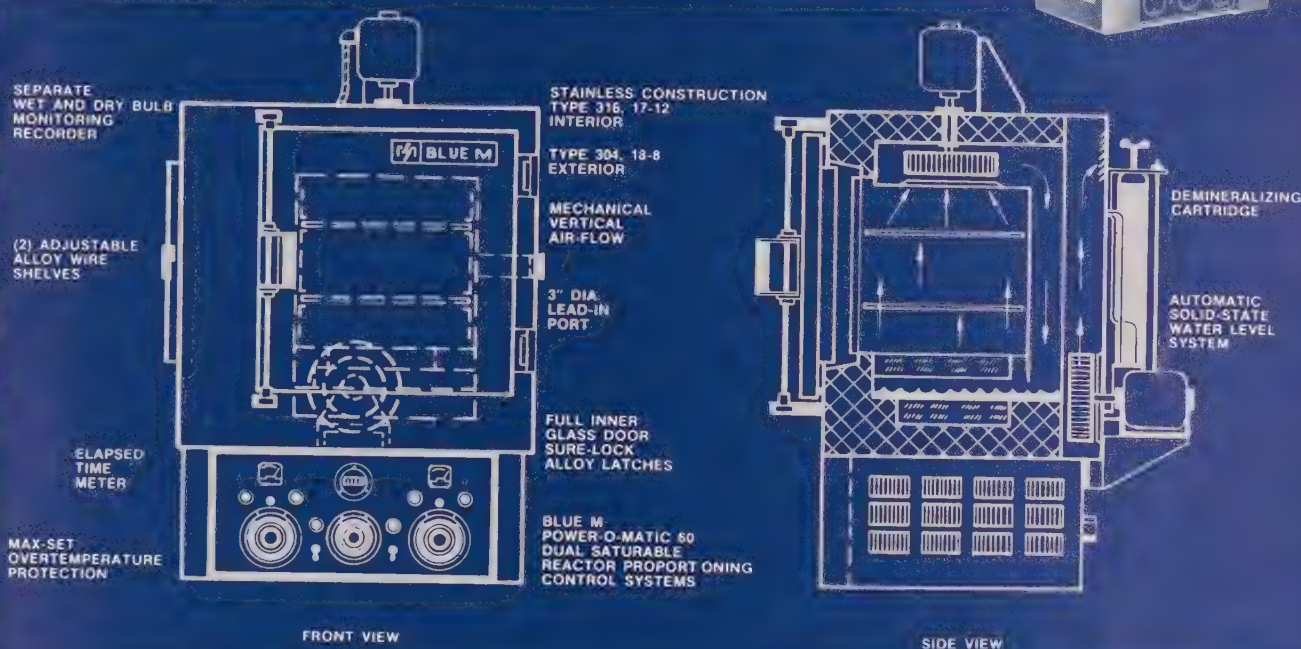
EQUIPMENT COVERED BY OUR EXCLUSIVE

PARTS WARRANTY and REPLACEMENT SERVICE PROGRAM



A BLUE M

STANDARD

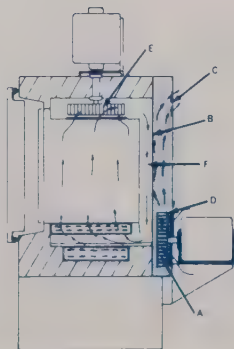


DEMINERALIZING CARTRIDGE—assures high purity water for many weeks operation. Minimizes corrosion.

LEAD-IN PORT

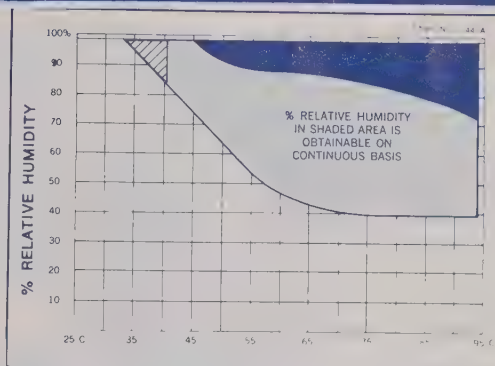
OPERATION

High efficiency blower system (A) drives ambient air through uniquely designed rear cavity, across rear heat exchanger chamber wall plate (B) and outward through vents (C) near top of cabinet. Cooling air is proportioned by damper (D). This reduces temperature of entire rear inner chamber wall surface. Internal blower system (E) forces internal air through rear plenum chamber (F), and air is cooled and controlled to proper dew point as it contacts rear wall (B). Air is then saturated and reheated to set conditions. NOTE: Cooling air does not contact conditioned air within work chamber.



DRY BULB TEMPERATURE (DEGREES CENTIGRADE)
Chart gives Relative Humidity obtainable using +21°C. (+70°F.) ambient air as the cooling medium.

NOTE: Area in solid blue indicates percentage of Relative Humidity which can be accurately controlled with the motor blower which propels the cooling air being OFF. Hatch-marked area is variable depending upon ambient temperature.



GENERAL SPECIFICATIONS

Model Number	Inside Dimensions Inches (Cm.)			Overall Dimensions Inches (Cm.)			Total KVA	Voltage 60 Hz. A.C. 1 Phase	Cubic Feet Cap.
	W.	D.	H.	W.	D.	H.			
AC-7502HA-1	20 (51)	14 (35)	20 (51)	38 (95)	35 (88)	54 (136)	2.7	*120 V	3.2
AC-7602HA-1	25 (63)	19 (48)	20 (51)	43 (109)	40 (101)	54 (136)	2.7	*120 V	5.5
AC-7702HB-1	37 (93)	19 (48)	25 (63)	55 (139)	40 (101)	59 (150)	4.0	208 V 240 V	10.0

*Models available for 240 V. and 208 V./1 Ph. operation with use of separate autoformer package complete with line cord and plug. Simple installation. All wiring complete and enclosed to meet N.E. Code, as amended.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: EXTRA CHARTS, EXTRA SHELVES, CABINET TYPE FLOOR STANDS, CASTERS, CRYSTAL-CLEAR WATER PURIFICATION SYSTEM, EXTRA DEMINERALIZING CARTRIDGES, HUMID-PAC ACCESSORY KIT, NEOPRENE RUBBER GLOVES AND/OR PORTS/PLUGS FOR INNER GLASS DOOR.

SEND FOR ADDITIONAL INFORMATION AND ALL PRICES

BLUE M EQUIPMENT

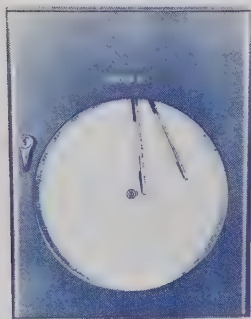
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New York, Elmsford 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
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Washington, Seattle 98108

ACCESSORIES FOR BLUE M CONSTANT TEMPERATURE/HUMIDITY CABINETS



2-PEN CIRCULAR CHART DIFFERENTIAL RECORDER

We believe the differential recorder to be an indispensable means to reliably and accurately portray actual operating conditions of temperature/humidity cabinets. A complete discussion of this equipment appears on pages 184-187. Charts showing the performance of a typical Blue M Full Range Constant Temperature/Humidity Cabinet as measured by a differential recorder appear there as well as on pages 30 and 31.

As these examples show, the differential recorder is infinitely superior to the common circular chart and dry bulb recorders commonly used. In fact, chamber performance as recorded on a typical circular chart is so vague as to be practically meaningless. Pictured opposite, however, is a circular chart (at right) which clearly differentiates between the wet and dry bulb performance. This chart, obtained from a Minneapolis-Honeywell Two Pen Differential Recorder, provides the operator with a clear, convenient representation of chamber performance. Dry bulb operation is the outer line, the simultaneous wet bulb performance is the inner line. The same program recorded on a conventional circular chart recorder is shown at left. Both were obtained from a Blue M Full Range Constant Temperature/Humidity Chamber such as is described on pages 32 and 33.

Over and above the obviously clear representation of chamber operation, the circular chart differential recorder offers the advantages of convenience—the charts are easier to read, handle, and file than strip chart records. Also, this particular type is much more economical initially. We recommend it highly, and suggest you consider it seriously when you consider purchase of a Blue M Full Range Temperature/Humidity Cabinet. Write for full pricing information.



All-stainless Blue M Crystal-Clear System comes complete, ready to use. Includes cover to keep out air-borne impurities.

RECOMMENDED
TANK LOCATION

120 V. RECEPTACLE
FOR PUMP

RIGHT SIDE VIEW

BLUE M CRYSTAL-CLEAR WATER PURIFICATION SYSTEM

The Blue M Crystal-Clear Water Purification System provides pure water free of the dissolved solids and gases in natural water which ruins stainless surfaces, particularly when heated. It consists of a 48 gallon, type 304, 18-8 stainless reservoir, demineralizer cartridge, large volume fine flow filter, pump, manual valve and piping. Installed behind the cabinet, it is filled with distilled water which is circulated through the chamber and returned to the reservoir for re-use. Since the water is pure initially, the 48 gallon supply and demineralizer will supply highly purified water for several weeks.

OPERATIONAL ADVANTAGES

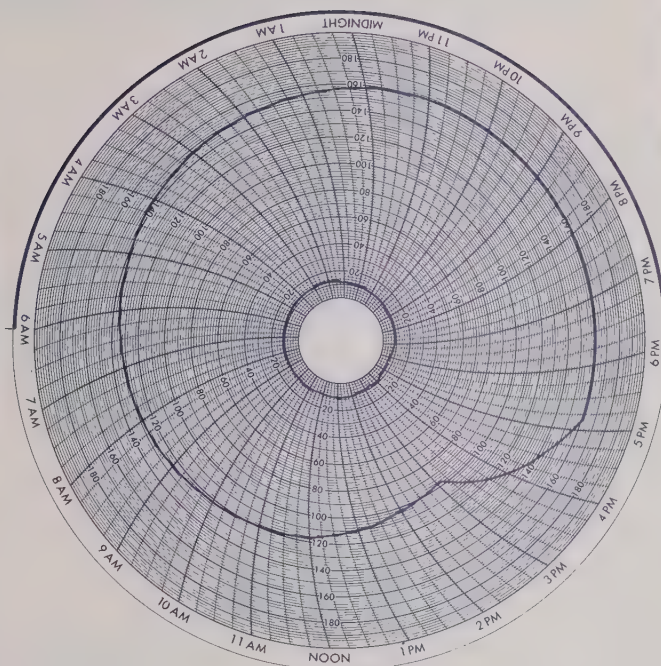
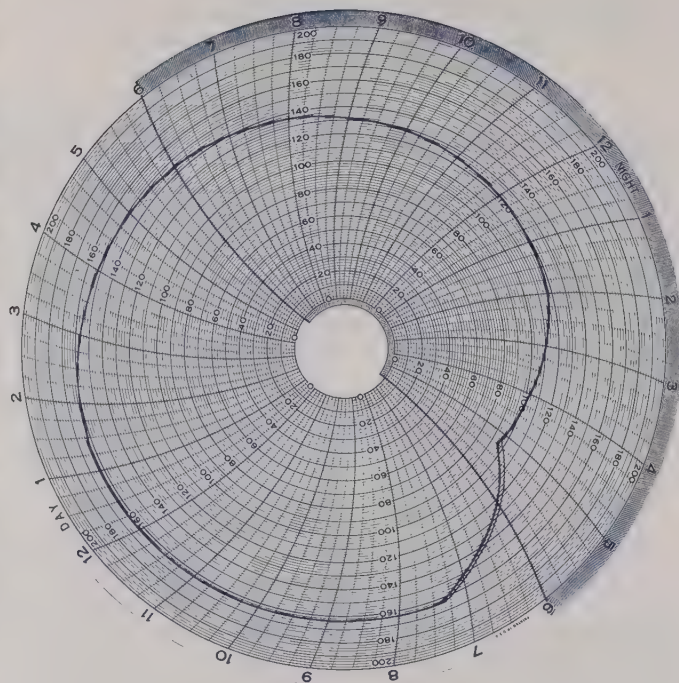
The unit successfully combats these problems:

CORROSION: Minerals in untreated water contribute to premature and rapid corrosion of cabinet interiors and/or vital interior components, particularly if chloride salts are present.

SCALE DEPOSITS: Calcium and magnesium, while not corrosive, plate out in the stainless water reservoir and seal the surface from oxygen. If chloride ions are trapped underneath, a continuous slow corrosion takes place.

MAINTENANCE: Scale will build up on stainless surfaces, including wet and dry bulb control sensors. Unit becomes "sluggish", becomes difficult to reach maximum temperature/humidity conditions and impossible to hold fine control tolerances without periodic cleaning.





A "MUST" ACCESSORY TO FIGHT CORROSION, MAINTAIN EFFICIENCY, AND MINIMIZE MAINTENANCE IN CONTROLLED TEMPERATURE AND HUMIDITY CHAMBERS

WATER HANDLING CONTROLS: Erratic cabinet behavior due to deterioration of solenoid valves, piping and flow control valves.

CHAMBER PRODUCTIVE OUTPUT: Perfect operation would be 365 productive test days per year. With Military Specifications, such as MIL-202, MIL-5272 and MIL-5422—this is only 36 complete 10-day tests.

Water problems mean down-time, drastically decreasing cabinet efficiency. If productivity drops below the level of your workload, additional chambers must be purchased. Losses by delays in test programs can be incalculable. Thus each additional day of operation per year is extremely valuable. The pure water from a Crystal-Clear System gives you these extra days!

ECONOMICAL ADVANTAGES

Many plants have quantities of distilled or de-ionized water for other processes. The small, 20 gal./day used by a small chamber is insignificant and a line is connected directly to the source of purified water. More often, conditioned water is not available and a small conditioning device is installed in the cabinet water line. Most used but also most expensive is the convenient replaceable cartridge. Output averages about 100 gallons of demineralized water for approximately \$9.00, or \$0.09 to \$0.10 per gallon. (Note: Areas with low hardness water get 2 or 3 times the output in gallons and substantially reduce the cost.) This costs between \$300.00 to \$700.00 per year on a chamber operating continuously—an expensive proposition!

Most large cities have water service companies. They will deliver and install large, replaceable demineralizers, cutting the cost per gallon to a more reasonable figure providing a large volume of water is used. However, it is usually not economical for one chamber. The Crystal-Clear System overcomes these disadvantages . . . can actually pay for itself in water purification costs alone in less than a year!

In addition, it offers these other important advantages:

A cabinet line is not necessary—eliminating a considerable initial cost plus continuing maintenance expenses.

A cabinet drain connection is not necessary—eliminating costly installation.

Cabinets can be installed and operated without regard for water supply, and can be moved any time. Such resultant benefits as reduced handling, better space utilization, etc. can represent a sizable saving. And one Crystal-Clear System can serve 3 to 4 chambers, installed side by side—also a significant economic advantage.

These advantages make the Crystal-Clear System a "must" for humidity chambers—your present equipment as well as the Blue M equipment described in this catalog. Write for full pricing information.

BLUE M EQUIPMENT

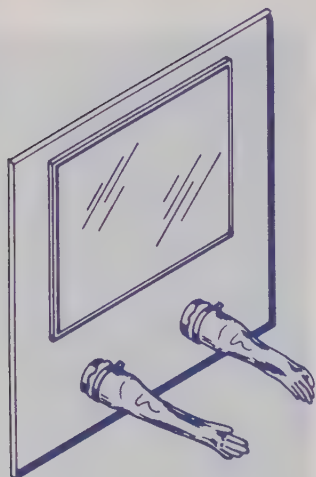
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New York, Elmsford 10523
New York, Syracuse 13206

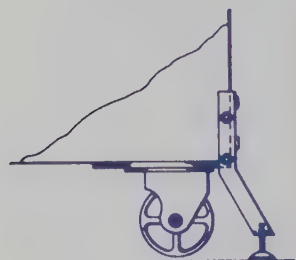
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Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

ACCESSORIES FOR BLUE M CONSTANT TEMPERATURE/HUMIDITY CABINETS



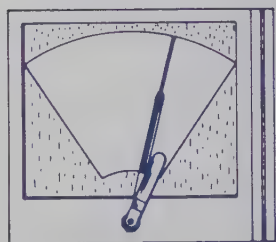
INNER GLASS DOOR WITH GLOVE PORTS

Heavy gauge stainless door with large heavy plate glass viewing area. Two stainless steel sleeves provide access to pair of neoprene rubber gloves attached to inside of door. Permits manipulation of workload in full view of operator without disturbing environmental conditions inside chamber. Not recommended for use at temperatures above +130°F.



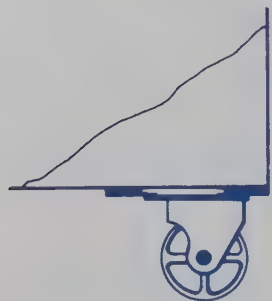
LEVELING LEGS

For use on cabinets with casters. Elevate entire unit from floor and level chamber accurately. Each alloy leg angle has adjustable swivel foot with a stainless pad. Quickly assures precise leveling on uneven floors. Set of four.



MANUAL WIPER FOR INNER GLASS DOOR

Manual wiper, with special inner glass door to accommodate it; permits visibility of work chamber interior under all operating conditions. Silicone rubber wiper encased in stainless holder easily oscillated by stainless mechanism outside door. Clears major portion of viewing area.

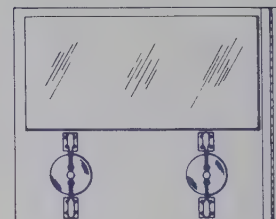


CASTERS

Heavy-duty industrial type swivel casters facilitate moving of units. Set of five required on cabinets with instrument consoles, four on others. Hard rubber wheels except for casters for largest models which are semi-steel.

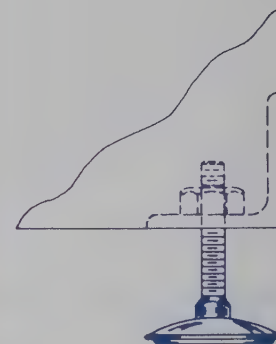
HAND PORTS WITH COVERS

Similar in design and construction to glove port door assembly at left. 6" diameter ports provide direct access to workload inside chamber. Stainless steel plug covers with plastic handles. Clamps seal and hold plugs firmly in place.



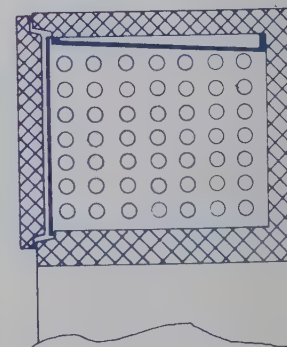
ADJUSTABLE FOOT LEVELERS

For use on cabinets without casters. Support unit and permit leveling on uneven floors. Easily adjusted, with stainless pad. Set of four.



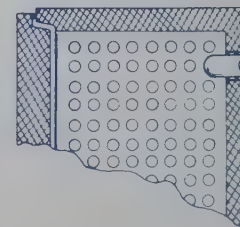
DRIP SHIELDS

Prevents possible condensation from settling on workload. Stainless steel, type 316. Installed at top of work chamber. Does not interfere with accessibility to workload.



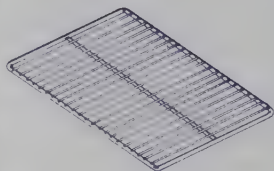
INTERIOR VAPOR-TIGHT LIGHT ASSEMBLY

100-watt bulb enclosed in special vapor-tight housing assembly provides ample illumination for chamber interior. Installed through rear chamber wall only. External on-off switch provided.



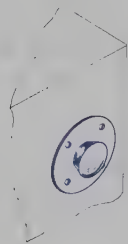
These accessories, like the Differential Recorder and the Crystal-Clear Water Purification System described on the previous page, are designed to make the operation of Blue M Temperature/Humidity Cabinets more

efficient. Individually or collectively they add to the versatility and convenience of your cabinet. They are typical of the complete line of accessories available.



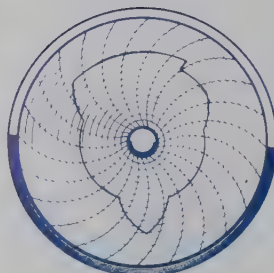
EXTRA SHELVES

Wire type, stainless steel, electro-polished available for all models, except 4' x 4' x 4' (64 cubic foot models). These large models employ shelf design of stainless steel tubular framing and expanded metal.



LEAD-IN PORTS

For entrance of electrical cables, etc. 3" diameter stainless steel tube, heli-arc welded and passivated. Equipped with rubber stopper. Exact location possible of one or more ports will vary with cabinet model. Check with factory or branch office as to recommended locations.



EXTRA PROGRAM CAMS AND CHARTS

Blank cams or cams cut to any desired program. Extra 12" diameter charts in boxes of 100. Scale: -18°C. to +93°C. or 0°F. to +200°F. Either available for 24-hour or 7-day drives. Suitable for all programmed units.



MANUAL CONTROLS (2)

Added versatility enabling cabinet to be used for single steady state conditions without use of programmer and cams. Mounted in same attractive panel as standard overtemperature protection on right side of instrument console.



Humid-Pac

ACCESSORY KIT

- Eliminates unnecessary down-time
- Helps assure maximum chamber utilization
- Avoids wasting time, effort, money
- Suitable for new and existing equipment

Everything you need to keep your chamber operating for approximately one year under normal use. Avoids bothersome ordering of individual items, and down-time due to lack of necessary supplies. Includes three dozen recorder wicks and one set of recorder pens, red and green recorder ink, six demineralizing cartridges, water level float, and four boxes of recorder charts, 100 charts per box. (Kind of charts must be specified.) Recommended for purchase with chamber as a supplement to the approximate 30-day supply of accessories furnished with unit, as well as periodically after chamber is placed in service.

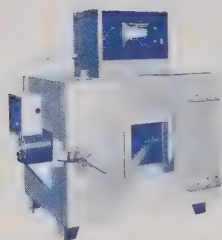
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Washington, Seattle 98108



BLUE M

REFRIGERATED TEST CHAMBERS

Technically Advanced Equipment to Reliably Reproduce Conditions of Cold to Exacting Test Requirements.

We can truthfully say that the Blue M Refrigerated Test Chambers described on the following pages bring the art of precisely controlling cold to the most advanced point yet achieved by any manufacturer.

If this sounds like a strong statement, fine. We mean it to sound that way. And when you consider that these units represent years of environmental chamber design and manufacturing experience coupled with the unequalled POWER-O-MATIC 60® Control, you will begin to understand why users agree with us.

BLUE M MECHANICAL REFRIGERATION

There are three basic types of mechanical refrigeration systems used in the chambers on the following pages. For simplicity's sake, we can consider them to be designed and built for light, intermediate and heavy-range performance and service. The units themselves fall into these same general classifications.

The first of these—Testonic Constant Temperature Environmental Cabinets—can be called relatively light range units. With a low temperature capability of 0°C. (-32°F.), these units feature Blue M's Versa-Kold Refrigeration System. This is a single-stage system using Refrigerant 12. Its compressor is an extra large, heavy-duty continuously operating type of ample capacity to reach the specified range of the cabinet.

Exemplifying the intermediate range type unit and refrigeration system are the Versa-Range Test Chambers with -40°C. to +93°C. (+200°F.) range. These feature Blue M's Versa-Kold Mechanical Refrigeration System. This is a single-stage system using Refrigerant 502.

Heavy-range type units include the standard Versa-Range Test Chambers with -73°C. to +204°C. (+400°F.) range. This series of units utilize Blue M's Versa-Kold

Cascade Mechanical Refrigeration System and Refrigerants 22 and 13.

Without entering into a more detailed description of this equipment (a Blue M factory-trained salesman will be glad to, at your convenience), we can say that it offers industry a number of positive advantages: improved thermal capacities with a relatively low compressor displacement and less total horsepower; lower operating temperature range; more compact installations; lower operating cost; low operating compressor temperatures; good compressor ratios, and simplified maintenance. It goes without saying that only the finest components make up these systems, and that they are carefully and individually tested before shipment. Our service personnel are always available to assist in setting up the unit for operation.

The broad range of Blue M Refrigerated Chambers available enables selection to be based on temperature—maximum and/or minimum, working chamber size, power available, use, manual or programmed operation, accessories, and so on. Regardless of the chamber selected, you are assured that all parts—cabinet, heating and refrigeration systems, controls—have been engineered, built, matched, and assembled into a unit offering exceptionally long, superior performance.

Although these chambers are separate and distinct from one another in design and purpose, you'll find that they all have one important thing in common: they offer the environmental test engineer and processor unusual flexibility in that they accurately reproduce elevated temperatures as well as cold. These aren't just "ice boxes". They are carefully engineered chambers with accurately controlled temperatures spanning as much as 600°F. and more.

Since virtually all of them feature the patented POWER-O-MATIC 60 Control, the explanation on earlier pages of how this device regulates temperature also applies to these chambers. This enables us to concentrate here on the refrigeration systems which permit these chambers to reach as low as -184°C.

All Blue M Refrigerated Test Chambers use only one of two basic refrigeration methods: mechanical refrigeration or direct injection of CO₂ or LN₂. The choice of method used is determined by two factors: (1.) Length of test or process; (2.) Cooling rate required.

If the test or process requires the use of cold for only short periods of time, or if testing is conducted only occasionally, then LN₂ or CO₂ is probably the most economical method. Short-term, occasional tests do not usually justify the expense of mechanical refrigeration systems. On the other hand, prolonged cabinet use at very cold temperatures requires large amounts of LN₂ or CO₂. Here, the relatively high initial cost of a mechanical

refrigeration system can be quickly amortized against the substantial and continuing cost of extended LN₂/CO₂ use.

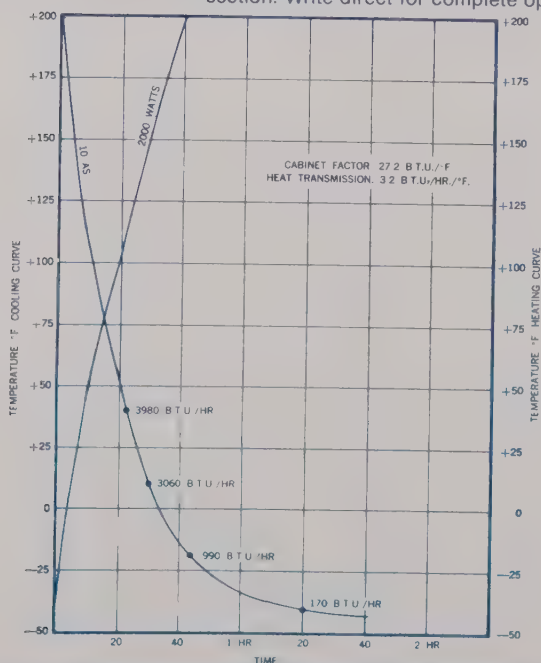
Desired cooling rates (air or product temperatures) also influence refrigeration method selection. If chamber temperature must be dropped very quickly, LN₂ will probably be specified—especially if MIL STD'S are involved. Our experience with MIL STD'S or severe in-house tests clearly indicates LN₂ as being the most practical and least troublesome to employ. Capacities of standard mechanically refrigerated units are normally inadequate for Thermal Shock Tests (see Pages 66-69), and are to be avoided since they are costly and require above average maintenance.

However, if cooling can be more gradual, then mechanical refrigeration is preferable from an economy standpoint whether it is manual or programmed. Of course, LN₂ is used to achieve the lower temperature—down to -184°C. CO₂ can be used to produce intermediate cold temperature—down to about -73°C.

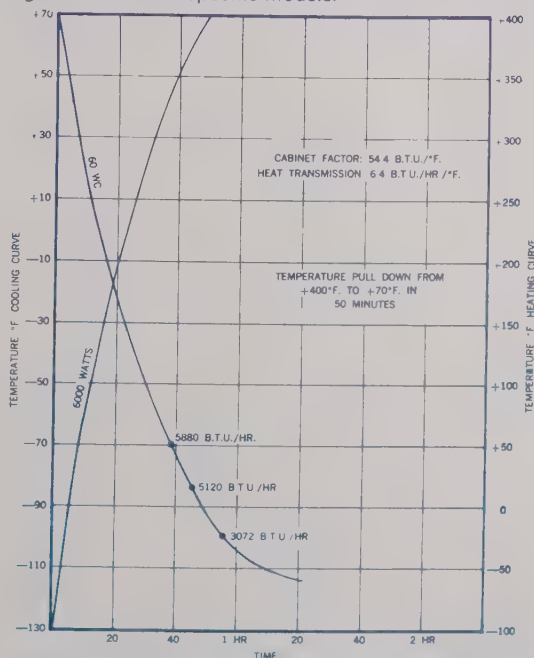
As is explained on the pertinent unit pages, LN₂ or CO₂ is introduced into the chamber by high quality solenoid valves designed especially for this service. Metering action of the valve, sensitive control performance and carefully engineered chamber design all add up to units of remarkable efficiency and reliability.

TYPICAL PERFORMANCE CHARTS BLUE M VERSA-RANGE® REFRIGERATED TEST CHAMBERS

These charts will serve as a guide to the performance of all units on the designated pages, and will serve as a measure of the efficiency of all the equipment in this section. Write direct for complete operating information on specific models.



8 CU. FT. MODEL, SINGLE-STAGE VERSA-KOLD MECHANICAL REFRIGERATION SYSTEM (See Page 54)



27 CU. FT. MODEL, CASCADE VERSA-KOLD MECHANICAL REFRIGERATION SYSTEM (See Page 52)

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Washington, Seattle 98108

APPLICATION:

How to reliably test and process parts and components at extremes of heat and cold in a single, efficient unit.

OPERATING AND CONTROL CHARACTERISTICS

TEMPERATURE RANGE

-73°C. to +204°C. (+400°F.)

CONTROL ACCURACY: $\pm 0.5^{\circ}\text{C}$.

SETABILITY: $\pm 1.0^{\circ}\text{C}$.

REPEATABILITY: $\pm 0.5^{\circ}\text{C}$.

Since performance of any given chamber is affected by such variables as operating temperature and unit size, please refer to performance chart on page 51 for typical operating data.

BLUE M CERTIFICATION

All tests conducted with no load, no exhaust, and stabilized chamber under normal conditions of voltage and ambient. When unusual line voltages, ambients, severe loads and exhaust rates exist, please contact local sales offices or factory for recommendations.

BLUE M GUARANTEE

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operating requirements.

SOLUTION:

BLUE M VERSA-RANGE® TEST CHAMBERS

with **POWER-O-MATIC 60**® Saturable Reactor Proportioning Control System and Versa-Kold Cascade Mechanical Refrigeration System.

Blue M Versa-Range Test Chambers are easily the most reliable and dependable units for critical high and low temperature testing ever built. They are recommended without reservation for research and military testing and processing of components and small parts which must be subjected to very low and/or high temperatures with absolute accuracy.

Patented POWER-O-MATIC 60 Control, providing true straight-line performance, is carefully matched with Blue M's exclusive Versa-Kold Cascade Mechanical Refrigeration System and quality heating system for maximum operating efficiency and economy. Non-cycling, continuously operating refrigeration system lowers chamber temperature quickly—reaches minimum in 60 minutes or less. Reactor-controlled heating system with mechanical convection air-flow enables testing to be conducted at elevated temperatures with extreme accuracy and dependability. Time delay MAX-SET over-temperature protection is now standard. Broad range of chamber sizes—3, 8, 12, 27 and 64 cubic feet—permits selection of just the right unit for the application. Small picture shows 3 cubic foot model; typical larger model is shown on next page.

It should be noted that the temperature range shown for these cabinets is the actual range obtained in service, and the upper limit is considerably higher than that available from competition. These are not misleading figures obtainable only with modifications as is the case with some competitive equipment. Also, Versa-Range Chambers are ideal for programming and can be programmed throughout their specified range without special instrumentation or modification.

Similar units with a more limited temperature range of -40°C. to +93°C. (+200°F.) are described elsewhere in this section.

GENERAL SPECIFICATIONS

CONTROL SYSTEM

POWER-O-MATIC 60 Saturable Reactor Proportioning Control System

MAX-SET™ OVERTEMPERATURE PROTECTION

MEMORY RING® Temperature Calibrating Dial

DIAL POINTER LOCK

ELAPSED TIME METER

REFRIGERATION PRESSURE GAUGES

READY-READ TEMPERATURE INDICATOR— $3\frac{1}{2}$ " diameter. Stainless sensing bulb.

PILOT LIGHTS—clearly identified for detailing each function.

CONTROL MOUNTING—all controls and switches in panel on top of 3 cu. ft. model only. Panel slanted for maximum visibility and operator convenience. Larger models have all controls conveniently installed in console cabinet at side of unit. Console illustrated is typical and can be modified to suit individual needs.

CONSTRUCTION

HOUSING—all-welded heavy gauge cold rolled steel, reinforced.

INTERIOR—type 304, 2B, heavy gauge stainless. All seams heli-arc welded vapor-tight.

EXTERIOR FINISH—grey Barcotone finish.

INSULATION—uni-cellular, non-settling, non-hygroscopic of ample thickness to maintain chamber temperature at control setting. Provides effective vapor shield barrier against moisture.

DOOR—same construction as chamber. Completely overlaps chamber opening. Special pressure type latch presses door securely against dual silicone and/or neoprene seals to prevent leakage.

ETERNA HEATER BANKS—cylindrical type, assure years of service. Shielded to prevent radiant heat.

AIR CIRCULATION—externally mounted ball bearing motor with stainless extended shaft and balanced multi-bladed blower fan designed especially for these units.

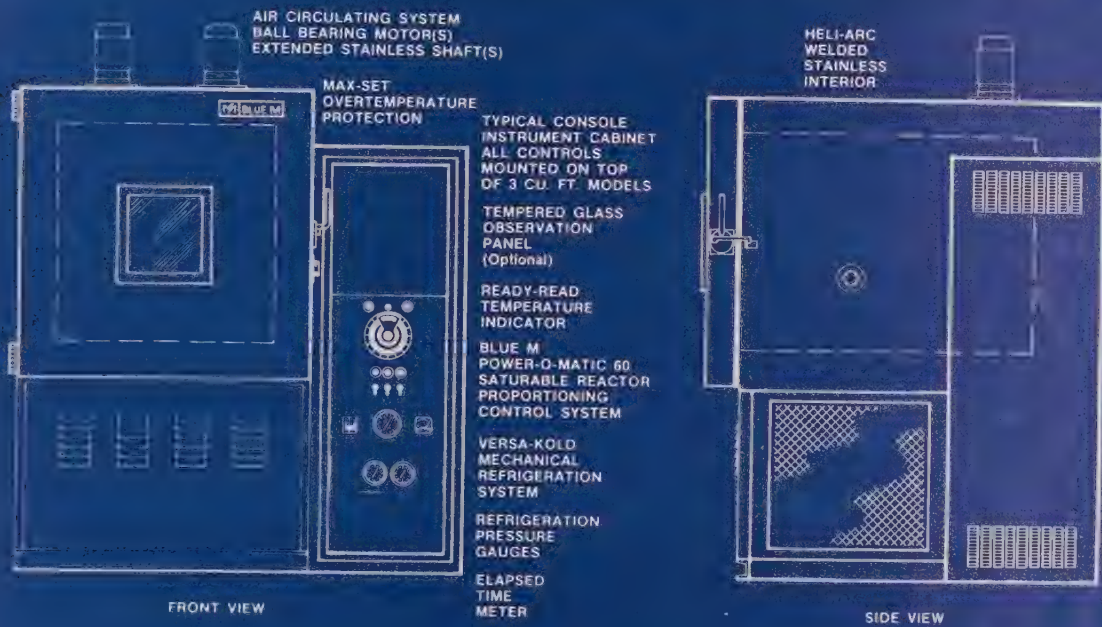
EQUIPMENT COVERED BY
OUR
EXCLUSIVE

PARTS
WARRANTY
and
REPLACEMENT
SERVICE
PROGRAM



A BLUE M

STANDARD



NON-CYCLING VERSA-KOLD REFRIGERATION SYSTEM

—cascade type using Refrigerants 22 and 13. Air-cooled system on two smaller models, water-cooled on large. Commercial type, heavy-duty, semi-hermetic Copeland compressors. Operate continuously. All-copper condenser. Oil separator minimizes oil flow. Copper finned blower coil. Rapid pull-down rate. Desuperheaters and attendant equipment automatically regulate return gas temperatures and hold them within acceptable limits even when chambers are operated at extreme upper range.

MOTOR OVERLOAD PROTECTION—built in for added safety.

SHELVES (OPTIONAL)—electropolished stainless. Sized to fit unit, with stainless brackets for shelf adjustment in 1/2" increments.

OPERATION

Set control for desired temperature. In cooling, Versa-Kold Refrigeration System quickly lowers temperature to required level . . . mechanical horizontal air-flow circulates cooled air uniformly. In heating, air heated by black heat, "controlled" low-watt density shielded Eterna elements is propelled mechanically and horizontally across working chamber for uniform heat distribution. NO RADIANT HEAT.

STEADY-STATE MODELS†

Model Number	Inside Dimensions Inches (Cm.)			*Overall Dimensions Inches (Cm.)			Total KVA	Voltage 60 Hz. A.C.	Cubic Feet Cap.
	W.	D.	H.	W.	D.	H.			
1004-3C	17 (43)	17 (43)	17 (43)	30 (76)	41 (104)	81 (205)	5.2	240V./1 Ph	3.0
1004-8C	24 (61)	24 (61)	24 (61)	62 (157)	54 (136)	79 (200)	7.0	240V./1 Ph	8.0
1004-12F	36 (90)	24 (61)	24 (61)	74 (187)	54 (136)	79 (200)	10.0	240V./3 Ph	12.0
1004-27F	36 (90)	36 (90)	36 (90)	74 (187)	66 (167)	88 (223)	15.7	240V./3 Ph.	27.0
1004-64F	48 (120)	48 (120)	48 (120)	90 (228)	84 (213)	101 (257)	27.4	240V./3 Ph	64.0

*Dimensions include blower motor height, and console instrument cabinet width on 8, 12, 27 and 64 cubic foot models

Other voltages: 3 and 8 cubic foot models, 208 and 480V./1 Ph. 12, 27 and 64 cubic foot models, 208 and 480V./3 Ph.

†Similar units with two-temperature programming or cam programming available.

All wiring complete and enclosed to meet N.E. Code, as amended.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: MULTI-PANE TEMPERED GLASS OBSERVATION PANELS, CASTERS, SHELVES, LEAD-IN PORTS, INTERIOR LAMP(S) AND SWITCH(ES), PROGRAMMING AND RECORDING

SEND FOR ADDITIONAL INFORMATION AND ALL PRICES

BLUE M EQUIPMENT

A SALES AND SERVICE BRANCH OF
BLUE M EQUIPMENT COMPANY
Corporate Headquarters, Blue Island, Illinois 60406

Arizona, Scottsdale 85251
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Georgia, Atlanta 30341

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Massachusetts, Framingham 01701
Michigan, Allen Park 48101
New York, Elmsford 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

APPLICATION:

How to reliably test and process parts and components at high and low temperature in a single, efficient chamber.

OPERATING AND CONTROL CHARACTERISTICS

TEMPERATURE RANGE

-40°C. to +93°C. (+200°F.)

CONTROL ACCURACY: $\pm 0.5^{\circ}\text{C}$.

SETABILITY: $\pm 1.0^{\circ}\text{C}$.

REPEATABILITY: $\pm 0.5^{\circ}\text{C}$.

Since performance of any given chamber is affected by such variables as operating temperature and unit size, please refer to performance charts on page 51 for typical operating data.

BLUE M CERTIFICATION

All tests conducted with no load, no exhaust, and stabilized chamber under normal conditions of voltage and ambient. When unusual line voltages, ambients, severe loads and exhaust rates exist, please contact local sales offices or factory for recommendations.

BLUE M GUARANTEE

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operating requirements.

SOLUTION:

BLUE M VERSA-RANGE® TEST CHAMBERS

with **POWER-O-MATIC 60**® Saturable Reactor Proportioning Control System and Versa-Kold Mechanical Refrigeration System.

These Blue M Versa-Range Test Chambers are recommended without reservation for handling critical components and small parts which must be subjected to low and/or high temperatures during testing or processing. For accuracy and reliability, they are easily the most dependable units for high and low temperature testing ever built.

The straight-line temperature control of the patented POWER-O-MATIC 60 complements Blue M's quality heating system and exclusive Versa-Kold Mechanical Refrigeration System to provide unequalled temperature control throughout the unit's range. Continuously operating, non-cycling refrigeration system lowers chamber temperature to minimum in one hour or less. Efficient heating system coupled with mechanical convection air-flow assures that all high temperature work meets the most exacting standards of accuracy. Time delay MAX-SET overtemperature protection is now standard. Chamber sizes of 3, 8, 12, 27 and 64 cubic feet fulfill any operational requirements. Small picture shows typical large model; 3 cubic foot model is pictured on previous page.

The temperature range shown for these chambers is the range actually obtained in service—not misleading figures obtained only with modifications as is the case with some competitive equipment. Moreover, these units are ideally suited for programming and can be programmed throughout their specific range without special instrumentation or modification.

Similar units with a broader temperature range of -73°C . to $+204^{\circ}\text{C}$. ($+400^{\circ}\text{F}$.) are described elsewhere in this section.

GENERAL SPECIFICATIONS

CONTROL SYSTEM

POWER-O-MATIC 60 Saturable Reactor Proportioning Control System.

MAX-SET™ OVERTEMPERATURE PROTECTION

MEMORY RING® Temperature Calibrating Dial

DIAL POINTER LOCK

ELAPSED TIME METER

REFRIGERATION PRESSURE GAUGES

READY-READ TEMPERATURE INDICATOR— $3\frac{1}{2}$ " diameter. Stainless sensing bulb.

PILOT LIGHTS—clearly identified for detailing each function.

CONTROL MOUNTING—all controls and switches in panel on top of 3 cu. ft. model only. Panel slanted for maximum visibility and operator convenience. Larger models have all controls conveniently installed in console cabinet at side of unit. Console illustrated is typical and can be modified to suit individual needs.

CONSTRUCTION

HOUSING—all-welded heavy gauge cold rolled steel, reinforced.

INTERIOR—type 304, 2B, heavy gauge stainless. All seams heli-arc welded vapor-tight.

EXTERIOR FINISH—gray Barcotone finish.

INSULATION—uni-cellular, non-settling, non-hygroscopic of ample thickness to maintain chamber temperature at control setting. Provides effective vapor shield barrier against moisture.

DOOR—same construction as chamber. Completely overlaps chamber opening. Special pressure type latch presses door securely against dual silicone and/or neoprene seals to prevent leakage.

ETERNA HEATER BANKS—cylindrical type, assure years of service. Shielded to prevent radiant heat.

AIR CIRCULATION—externally mounted ball bearing motor with stainless extended shaft and balanced multi-bladed blower fan designed especially for these units.

EQUIPMENT COVERED BY
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EXCLUSIVE

PARTS
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and
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SERVICE
PROGRAM

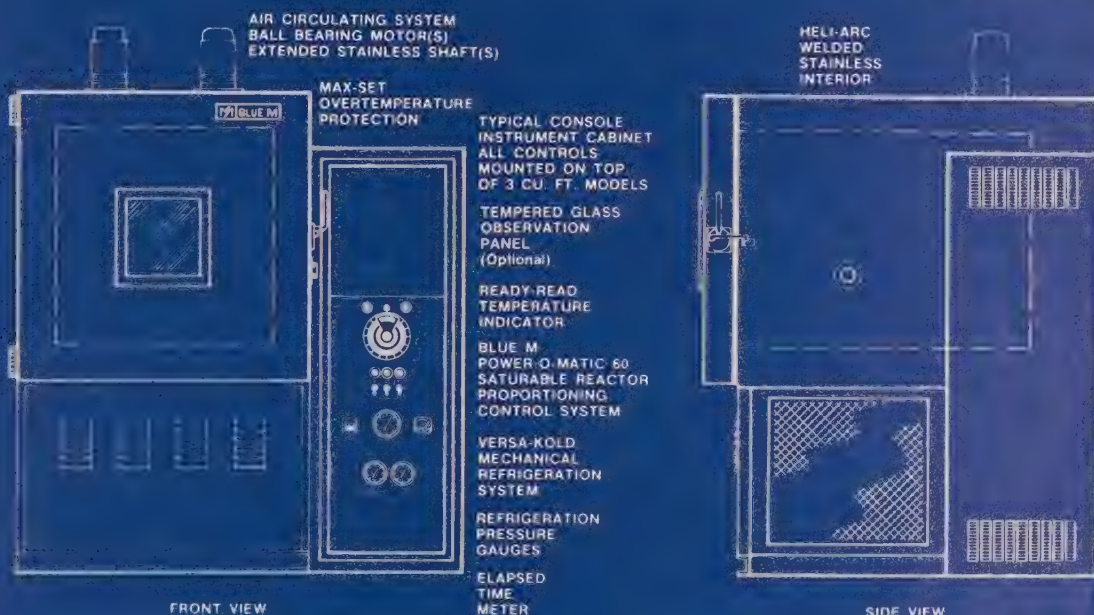


BLUE M

A BLUE M

STANDARD

ENVIRONMENTAL



NON-CYCLING VERSA-KOLD REFRIGERATION SYSTEM

—single stage using Refrigerant 502. Air-cooled system on two smaller models, water-cooled on large. Commercial type, heavy-duty, semi-hermetic Copeland compressors. Operate continuously. Oil separator minimizes oil flow. Finned type blower coil. Rapid pull-down rate. Desuperheaters and attendant equipment automatically regulate return gas temperatures and hold them within acceptable limits even when chambers are operated at extreme upper range.

MOTOR OVERLOAD PROTECTION—built in for added safety.

SHELVES (OPTIONAL)—electropolished stainless. Sized to fit unit, with stainless brackets for shelf adjustment in 1/2" increments.

OPERATION

Set control for desired temperature. In cooling, Versa-Kold Refrigeration System quickly lowers temperature to required level. . . . mechanical horizontal air-flow circulates cooled air uniformly.

In heating, air heated by black heat, "controlled" low-watt density shielded Eterna elements is propelled mechanically and horizontally across working chamber for uniform heat distribution. NO RADIANT HEAT.

STEADY-STATE MODELS†

Model Number	Inside Dimensions Inches (Cm.)			*Overall Dimensions Inches (Cm.)			Total KVA	Voltage 60 Hz. A.C.	Cubic Feet Cap.
	W.	D.	H.	W.	D.	H.			
1002-3C	17 (43)	17 (43)	17 (43)	30 (76)	41 (104)	81 (205)	3.4	240V./1 Ph	3.0
1002-8C	24 (61)	24 (61)	24 (61)	62 (157)	54 (136)	79 (200)	5.0	240V./1 Ph	8.0
1002-12F	36 (90)	24 (61)	24 (61)	74 (187)	54 (136)	79 (200)	6.1	240V./3 Ph	12.0
1002-27F	36 (90)	36 (90)	36 (90)	74 (187)	66 (167)	88 (223)	8.1	240V./3 Ph.	27.0
1002-64F	48 (120)	48 (120)	48 (120)	90 (228)	84 (213)	101 (257)	15.5	240V./3 Ph	64.0

*Dimensions include blower motor height, and console instrument cabinet width on 8, 12, 27 and 64 cubic foot models.

Other voltages: 3 and 8 cubic foot models, 208 and 480V./1 Ph. 12, 27 and 64 cubic foot models, 208 and 480V./3 Ph.

†Similar units with two temperature programming or cam programming available.

All wiring complete and enclosed to meet N.E. Code, as amended.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: MULTI-PANE TEMPERED GLASS OBSERVATION PANELS, CASTERS, SHELVES, LEAD-IN PORTS, INTERIOR LAMP(S) AND SWITCH(ES), PROGRAMMING AND RECORDING.

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New York, Elmsford 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

APPLICATION: How to conduct various tests and processes or store critical organic and inorganic material at extremely low temperatures.

OPERATING AND CONTROL CHARACTERISTICS

TEMPERATURE RANGE

Ambient to -85°C. (-120°F.)

***PULL-DOWN TIME** (No Load)

To minimum: 60 to 120 minutes.

*Pull-down rates are generally not critical requirements with chambers of this type. Therefore, Blue M units are designed with performance pull-down rate capabilities in accordance with a quality refrigeration system.

CONTROL ACCURACY: $\pm 1.0^{\circ}\text{C}$.

SETABILITY: $\pm 2.0^{\circ}\text{C}$.

REPEATABILITY: $\pm 1.0^{\circ}\text{C}$.

TYPICAL AIR TEMPERATURE UNIFORMITY

$\pm 2^{\circ}\text{C}$. at lower portion of range.

BLUE M CERTIFICATION

All tests conducted with no load, no exhaust, and stabilized chamber under normal conditions of voltage and ambient. When unusual line voltages, ambients, severe loads and exhaust rates exist, please contact local sales offices or factory for recommendations.

BLUE M GUARANTEE

When applications are factory approved, we **GUARANTEE** to supply unit(s) meeting your operating requirements.

SOLUTION:

BLUE M VERSA-RANGE® CHEST-TYPE REFRIGERATED TEST CHAMBERS

with Versa-Kold Cascade Mechanical Refrigeration System.

In design, construction and performance these Blue M Versa-Range Chambers offer the industrial processor, test specialist and research scientist alike an efficient, reliable source of extreme cold. Available with work chamber volumes of 3, 10 and 27 cubic feet, the units have a temperature range from ambient to -85°C.

Blue M's proven Microtrol Control, a reliable sensitive bulb type controlling thermostat, is coupled with the exclusive Versa-Kold Cascade Mechanical Refrigeration System to offer economical, efficient performance which can be relied upon under all normal operating conditions. Refrigeration system has ample capacity to lower chamber temperature quickly. Special bare tube evaporator coil provides maximum direct refrigerant contact for optimum cooling efficiency.

Suitable for innumerable applications requiring an extremely cold environment, these chambers are particularly well suited for such work as steel stabilization where dimensions must be held within very fine tolerances. They are also ideal for hardening metals such as are used by the cutting tool industry. Typical additional uses include shrink-fit assembly, gauge seasoning, reliability testing, storage of resins, adhesives and chemicals, biological and pharmaceutical storage, and pre-freezing in conjunction with freeze-drying processing.

It is important to note that these units—like all Blue M refrigerated test chambers—are carefully engineered and quality-built to provide long life and truly trouble-free service. They should not be compared with competitive equipment where actual performance has been sacrificed for price.

Similar Blue M chambers with a temperature range to -40°C. are described on the following catalog page. The unit pictured here typifies the larger model, the illustration on the following page shows the small models for both series.

GENERAL SPECIFICATIONS

CONTROL SYSTEM

BLUE M MICROTROL (Controlling Thermostat)—Sensitive remote bulb type. Uniform on-off differential. Effective ambient temperature compensation built-in. Stainless steel (type 316) capillary tube and thermal bulb with range to suit chamber. Standard dials are graduated in degrees Fahrenheit. Can be supplied in degrees Centigrade if specified.

MEMORY RING® Temperature Calibrated Dial

DIAL POINTER LOCK

READY-READ TEMPERATURE INDICATOR—3½" diameter. Stainless sensing bulb.

MAIN SWITCH—on small models

CIRCUIT BREAKER—on larger models

COOLING SWITCH—on larger models

REFRIGERATION PRESSURE GAUGES

PILOT LIGHTS

CONTROL MOUNTING—all controls and switches mounted in base of small models. Larger models have all controls installed in console cabinet at side of unit as illustrated.

CONSTRUCTION

HOUSING—all-welded heavy gauge galvanized cold rolled steel, reinforced.

INTERIOR—heavy gauge stainless steel. Refrigerant circulated through special bare tube evaporator coil providing maximum direct refrigerant contact. Superior to ordinary wrap around cooling coil often used.

EXTERIOR—gray Barcotone finish.

INSULATION—uni-cellular, non-settling, non-hygroscopic of ample thickness to maintain chamber at control setting. Provides effective vapor shield barrier against moisture.

COUNTER-BALANCED DOOR (SMALL MODELS)—5" thick, of heavy gauge steel. Fingertip opening and closing, remains open at any desired angle. Closed securely against neoprene rubber seal by heavy-

EQUIPMENT COVERED BY

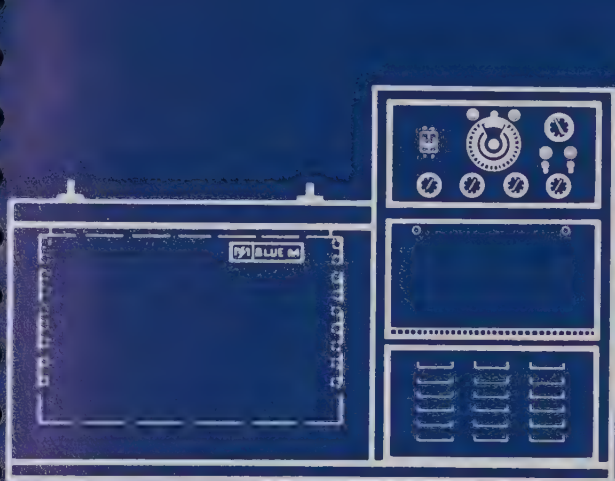
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A BLUE M

STANDARD



FRONT VIEW

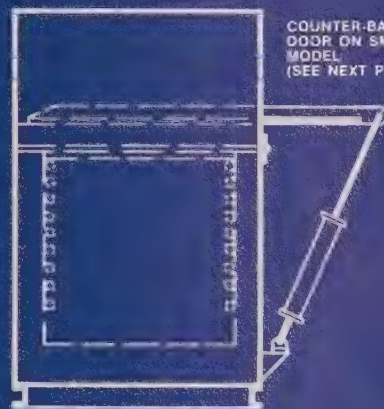
BLUE M
MICROTROL
CONTROL
WITH
MEMORY
RING DIAL

REFRIGERATION
PRESSURE GAUGES

READY-READ
TEMPERATURE
INDICATOR

BARE TUBE
EVAPORATOR
COIL

VERSA-KOLD
CASCADE
MECHANICAL
REFRIGERATION
SYSTEM



SIDE VIEW

PNEUMATIC
OPERATED DOOR
(LARGE MODEL)

COUNTER-BALANCED
DOOR ON SMALL
MODEL
(SEE NEXT PAGE)

duty chrome-plated clamp-type latches.

PNEUMATIC-OPERATED DOOR (LARGE MODEL)

—6" thick, of heavy gauge steel. Switch on control panel actuates heavy-duty air cylinder to open door and hold it open to provide full access to interior. Cylinder also smoothly closes door firmly against neoprene rubber seal.

VERSA-KOLD REFRIGERATION SYSTEM

—cascade type using Refrigerants R-502 and R-503. Air-cooled system on small models, water-cooled on large. Semi-hermetic Copeland compressors. All-copper condenser. Oil separator minimizes oil flow. Rapid pull-down rate.

MOTOR OVERLOAD PROTECTION—built in for added safety.

OPERATION

Set control for desired temperature. Versa-Kold Refrigeration System quickly lowers temperature to required level by circulating refrigerant through bare tube evaporator coil. Resulting maximum refrigerant contact assures unmatched cooling efficiency.

GENERAL SPECIFICATIONS

Model Number	Inside Dimensions Inches (Cm.)			*Overall Dimensions Inches (Cm.)			Refrig. H.P.	Voltage 60 Hz. A.C.	Cubic Feet Cap.
	L.	W.	D.	L.	W.	D.			
TC120-3A	18 (45)	18 (45)	16 (40)	31 (78)	34 (86)	49 (123)	1	120V./1 Ph.	3.0
TC120-10C	60 (152)	18 (45)	16 (40)	74 (187)	35 (88)	49 (123)	2	240V./1 Ph.	10.0
TC120-27F	36 (90)	36 (90)	36 (90)	96 (244)	53 (133)	72 (183)	4	240V./3 Ph.	27.0

*Overall width on 27 cubic foot model does not include space required for air-operated door opener.

Other voltages: 208 and 480 V./1 Ph. on 10 cubic foot model.
208 and 480 V./3 Ph. on 27 cubic foot model.

All wiring complete and enclosed to meet N.E. Code, as amended.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: CASTERS (TWO SMALLER MODELS ONLY), RECORDER, AND TEMPERATURE RISE ALARM.

SEND FOR ADDITIONAL INFORMATION AND ALL PRICES

BLUE M EQUIPMENT

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New York, Elmsford 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

APPLICATION:

How to process, test and/or store vital organic materials or parts and components at very low temperatures.

OPERATING AND CONTROL CHARACTERISTICS

TEMPERATURE RANGE

Ambient to -40°C . (-40°F .)

*PULL-DOWN TIME (No Load)

To minimum: 60 to 120 minutes.

*Pull-down rates are generally not critical requirements with chambers of this type. Therefore, Blue M units are designed with performance pull-down rate capabilities in accordance with a quality refrigeration system.

CONTROL ACCURACY: $\pm 1.0^{\circ}\text{C}$.

SETABILITY: $\pm 2.0^{\circ}\text{C}$.

REPEATABILITY: $\pm 1.0^{\circ}\text{C}$.

TYPICAL AIR TEMPERATURE UNIFORMITY

$\pm 2^{\circ}\text{C}$. at lower portion of range.

BLUE M CERTIFICATION

All tests conducted with no load, no exhaust, and stabilized chamber under normal conditions of voltage and ambient. When unusual line voltages, ambients, severe loads and exhaust rates exist, please contact local sales offices or factory for recommendations.

BLUE M GUARANTEE

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operating requirements.

SOLUTION:

BLUE M VERSA-RANGE® CHEST-TYPE REFRIGERATED TEST CHAMBERS

with Versa-Kold Mechanical Refrigeration System.

As a reliable, efficient source for a chilled environment to -40°F ., Blue M Versa-Range Chambers have no equal. Versatile work chamber volumes of 3, 10 and 27 cubic feet enable processors of industrial components, test specialists and research scientists to select the exact chamber to fit their requirements.

Featuring Blue M's exclusive single-stage Versa-Kold Mechanical Refrigeration System under control of the widely accepted Microtrol Control, the units provide accurate, economical performance throughout their range. Refrigeration system lowers temperature quickly while bare tube evaporator coil provides maximum direct refrigerant contact for optimum cooling efficiency. Simple, bulb type controlling thermostat assures dependable long-life service.

Designed and built to fit any number of applications where very cold temperatures are needed, these units are especially valuable for aluminum storage—to cite just one example—where contact with a chilled environment preserves the workability of the metal. Other important uses include shrink-fit assembly, gauge seasoning, reliability testing, storage of resins, adhesives and chemicals, biological and pharmaceutical storage, and pre-freezing in conjunction with freeze-drying processing.

The result of years of refrigeration and refrigerated equipment experience, these Blue M units assure the discriminating buyer the quality and performance he expects and demands from a superior facility.

Similar Blue M chambers with a temperature range to -85°C . are described on the preceding page. The unit pictured here shows the small model, the illustration on the preceding page typifies the larger model for both series.

GENERAL SPECIFICATIONS

CONTROL SYSTEM

BLUE M MICROTROL (Controlling Thermostat)—

Sensitive remote bulb type. Uniform on-off differential. Effective ambient temperature compensation built-in. Stainless steel (type 316) capillary tube and thermal bulb with range to suit chamber. Standard dials are graduated in degrees Fahrenheit. Can be supplied in degrees Centigrade if specified.

MEMORY RING® Temperature Calibrating Dial

DIAL POINTER LOCK

READY-READ TEMPERATURE INDICATOR— $3\frac{1}{2}$ " diameter. Stainless sensing bulb.

MAIN SWITCH—on small models

CIRCUIT BREAKER—on larger models

COOLING SWITCH—on larger models

REFRIGERATION PRESSURE GAUGES

PILOT LIGHTS

CONTROL MOUNTING—all controls and switches mounted in base of small models. Larger models have all controls installed in console cabinet at side of unit.

CONSTRUCTION

HOUSING—all-welded heavy gauge galvanized cold rolled steel, reinforced.

INTERIOR—heavy-gauge stainless steel. Refrigerant circulated through special bare tube evaporator coil providing maximum direct refrigerant contact. Superior to ordinary wrap around cooling coil often used.

EXTERIOR FINISH—grey Barcotone finish.

INSULATION—uni-cellular, non-settling, non-hygroscopic of ample thickness to maintain chamber at control setting. Provides effective vapor shield barrier against moisture.

COUNTER-BALANCED DOOR (SMALL MODELS)— $5\frac{1}{2}$ " thick, of heavy gauge steel. Fingertip opening and closing, remains open at any desired angle. Closed

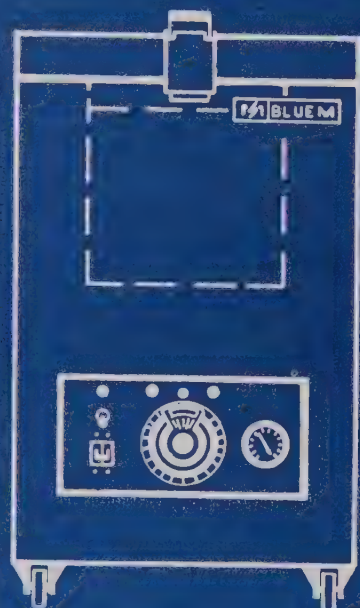
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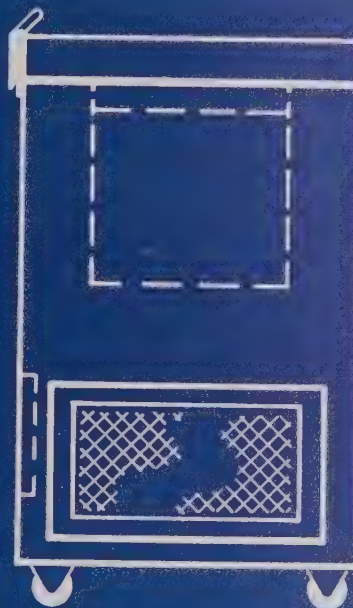


A BLUE M

STANDARD



FRONT VIEW



SIDE VIEW

COUNTER-BALANCED DOOR (SMALL MODEL)

PNEUMATIC OPERATED DOOR ON LARGE MODEL (SEE PREVIOUS PAGE)

CASTERS (Optionally Available on Small Models Only)

BLUE M MICROTRON CONTROL WITH MEMORY RING DIAL

READY-READ TEMPERATURE INDICATOR

VERSA-KOLD MECHANICAL REFRIGERATION SYSTEM

securely against neoprene rubber seal by heavy-duty chrome-plated clamp-type latches.

PNEUMATIC-OPERATED DOOR (LARGE MODEL)—

6" thick, of heavy gauge steel. Switch on control panel actuates heavy-duty air cylinder to open door and hold it open to provide full access to interior. Cylinder also smoothly closes door firmly against neoprene rubber seal.

VERSA-KOLD REFRIGERATION SYSTEM—single-

stage using Refrigerant 502. Air-cooled system on small models, water-cooled on large. Semi-hermetic Copeland compressors. All-copper condenser. Oil separator minimizes oil flow. Rapid pull-down rate.

MOTOR OVERLOAD PROTECTION—built in for added safety.

OPERATION

Set control for desired temperature. Versa-Kold Refrigeration System quickly lowers temperature to required level by circulating refrigerant through bare tube evaporator coil. Resulting maximum refrigerant contact assures unmatched cooling efficiency.

GENERAL SPECIFICATIONS

Model Number	Inside Dimensions Inches (Cm.)			*Overall Dimensions Inches (Cm.)			Refrig. H.P.	Voltage 60 Hz. A.C.	Cubic Feet Cap.
	L.	W.	D.	L.	W.	D.			
TC40-3A	18 (45)	18 (45)	16 (40)	31 (78)	34 (86)	49 (123)	1/2	120V./1 Ph.	3.0
TC40-10C	60 (152)	18 (45)	16 (40)	74 (187)	35 (88)	49 (123)	1	240V./1 Ph.	10.0
TC40-27F	36 (90)	36 (90)	36 (90)	96 (244)	53 (133)	55 (139)	2	240V./3 Ph.	27.0

*Overall width on 27 cubic foot model does not include space required for air-operated door opener.

Other voltages: 208 and 480 V./1 Ph. on 10 cubic foot model.
208 and 480 V./3 Ph. on 27 cubic foot model.

All wiring complete and enclosed to meet N.E. Code, as amended.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: CASTERS (TWO SMALLER MODELS ONLY), RECORDER, AND TEMPERATURE RISE ALARM.

SEND FOR ADDITIONAL INFORMATION AND ALL PRICES

BLUE M EQUIPMENT

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New York, Elmsford 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

APPLICATION:

How to efficiently and accurately conduct MIL tests at both below zero and elevated temperatures with a single reliable unit.

OPERATING AND CONTROL CHARACTERISTICS
LN₂

(Solid-State Instrumentation)

TEMPERATURE RANGE

-185°C. to +200°C. (+392°F.)

RUN-UP TIME

-185°C. to +200°C.: 60 minutes.

CONTROL ACCURACY: ±1%.

CO₂

(Solid-State Instrumentation)

TEMPERATURE RANGE

-73°C. to +300°C. (+572°F.)

RUN-UP TIME

-65°C. to +300°C.: 48 minutes.

CONTROL ACCURACY: ±1%.

(BLUE M Microtrol & Ready-Read Thermometer).

TEMPERATURE RANGE

-73°C. to +204°C. (+400°F.)

RUN-UP TIME

-65°C. to +200°C.: 33 minutes.

CONTROL ACCURACY: ±1%.

UNIFORMITY—ALL MODELS

OPER. TEMP.	UNIFORMITY
--------------------	-------------------

-65°C.	±.75°C.
+125°C.	±1.25°C.
+200°C.	±1.75°C.

SOLUTION:

BLUE M STABIL-THERM® LN₂ CONSTANT TEMPERATURE ENVIRONMENTAL CHAMBERS

(also available for use with CO₂)

(Front Opening)

These Blue M Mechanical Convection Horizontal Air-Flow Chambers represent a reliable, practical way to conduct MIL tests at both high and low temperatures. They have been engineered to permit either LN₂ or CO₂ to be used as the cooling medium. However, LN₂ is recommended because it is cleaner, cools faster, and allows longer test periods. CO₂ will produce dry ice build-up which necessitates defrosting thus reducing the test time available. But from an operational standpoint, these chambers work well with either medium, and Blue M can supply them for CO₂ service whenever LN₂ is not available.

When cooling with LN₂, units are equipped with a solid-state indicating control potentiometer (illustrated). When CO₂ is used, units come with either solid-state electronic instrumentation or with Blue M's Microtrol Control and Ready-Read temperature indicator—depending on temperature range selected. All instrumentation, pilot lights and switches are housed in a separate compartment.

As the construction specifications clearly indicate, these chambers are rugged, quality-built units. They have been designed for maximum severity service, and should not be confused with competitive chambers where performance is often sacrificed for price.

Similar top opening chambers—recommended when the door is opened frequently—are shown on the next page.

GENERAL SPECIFICATIONS

CONTROL SYSTEMS

SOLID-STATE INDICATING CONTROL—units with range from -185°C. to +200°C. (+392°F.) using LN₂, and units with range from -73°C. to +300°C. (+572°F.) using CO₂. Potentiometric design featuring advanced integrated circuitry and time proportioning. Illuminated direct read-out dial with 8" scale provides setting accuracy to within 0.5% of scale. Indication is 50% of span on either side of setpoint. Indication accuracy is ±1% of full scale. Appropriate Centigrade range standard, Fahrenheit available when specified at time of order.

BLUE M MICROTROL (Controlling Thermostat)—units with range from -73°C. to +204°C. (+400°F.) when using CO₂. Sensitive remote bulb type control. Uniform on-off differential. Dual scale in C. and F.

READY-READ TEMPERATURE INDICATOR—supplied when Microtrol Control is used. 3½" diameter. Stainless sensing bulb and matching scale.

BUILT-IN OVERTEMPERATURE PROTECTION (ALL MODELS)—solid-state instrument complements main control and conveniently installed adjacent to it. Features MAX-SET time-delay circuitry. Easily set. Positive protection at all times.

SEPARATE CONTROL COMPARTMENT—houses instrumentation, pilot lights and switches.

THERMOCOUPLES AND LEAD WIRE—included with all electronic instruments.

SOLENOID VALVE—especially designed for medium used in cooling.

MAIN SWITCH
PILOT LIGHTS
CONSTRUCTION

HOUSING—all-welded heavy gauge cold rolled steel, reinforced. Front of cabinet is 18-8 stainless.

WALLS—triple side walls.

INTERIOR—type 304, 18-8 stainless, heli-arc welded and passivated.

EXTERIOR FINISH—attractive blue enamel.

INSULATION—Marinite and Fiberglas.

DOOR—inside facing of stainless steel. Insulation same as unit. Chrome-plated hardware.

ETERNA HEATER BANKS—cylindrical type, assure years of service.

AIR CIRCULATION—quality ball bearing motor and balanced multi-bladed turbo blower designed especially for these units.

SHELF—one, type 304, 18-8 stainless, adjustable; 8 positions for 25" x 20" x 20" size and 5 positions

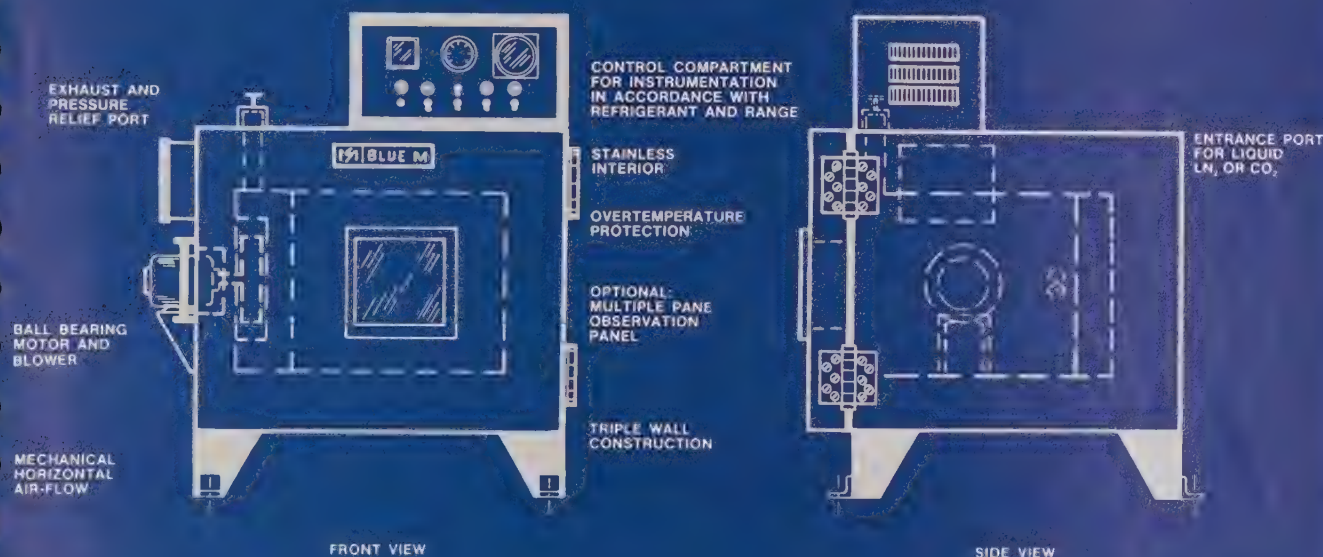
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GENERAL SPECIFICATIONS

LN₂

-185°C. to +200°C. (+392°F.)

Model Number	Inside Dimensions Inches (Cm.)			Overall Dimensions Inches (Cm.)			Total KVA	Voltage 60 Hz. A.C. 1 Phase	Cubic Feet Cap.
	W.	D.	H.	W.	D.	H.			
LN-160C-1	14 (35)	14 (35)	14 (35)	36½ (91)	27 (68)	44 (111)	2.4	*240V	1.6
LN-270C-1	25 (63)	20 (51)	20 (51)	51 (128)	33 (81)	50 (126)	4.4	*240V	5.8

CO₂

-73°C. to +204°C. (+400°F.)

(BLUE M Microtrol)

CO-140A-1	14 (35)	14 (35)	14 (35)	36½ (91)	27 (68)	44 (111)	1.5	120 V	1.6
CO-250C-1	25 (63)	20 (51)	20 (51)	51 (128)	33 (81)	50 (126)	2.8	*240 V	5.8

-73°C. to +300°C. (+572°F.)

(Solid-State Instrumentation)

CO-160C-1	14 (35)	14 (35)	14 (35)	36½ (91)	27 (68)	44 (111)	2.4	*240 V	1.6
CO-270C-1	25 (63)	20 (51)	20 (51)	51 (128)	33 (81)	50 (126)	4.4	*240 V	5.8

*Models also available for 208V./1 Ph.

All wiring complete and enclosed to meet N.E. Code, as amended.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: MULTIPLE PANE GLASS OBSERVATION PANELS, EXTRA SHELVES, REMOVABLE BASKETS, INTERIOR LAMP AND SWITCH, SPECIAL FITTINGS, LEAD-IN PORTS, ELECTRICAL TERMINALS, RECORDING AND PROGRAMMING INSTRUMENTATION.

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Georgia, Atlanta 30341

Illinois, Blue Island 60406
Massachusetts, Framingham 01701
Michigan, Allen Park 48101
New York, Elmsford 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

APPLICATION: How to conduct MIL tests at both below zero and elevated temperatures efficiently and accurately in a single reliable unit.

OPERATING AND CONTROL CHARACTERISTICS

LN₂

(Solid-State Instrumentation)

TEMPERATURE RANGE

-185°C. to +200°C. (+392°F.)

RUN-UP TIME

-185°C. to +200°C.: 60 minutes.

CONTROL ACCURACY: ±1%.

CO₂

(Solid-State Instrumentation)

TEMPERATURE RANGE

-73°C. to +300°C. (+572°F.)

RUN-UP TIME

-65°C. to +300°C.: 48 minutes.

CONTROL ACCURACY: ±1%.

(BLUE M Microtrol & Ready-Read Thermometer)

TEMPERATURE RANGE

-73°C. to +204°C. (+400°F.)

RUN-UP TIME

-65°C. to +200°C.: 33 minutes.

CONTROL ACCURACY: ±1%.

UNIFORMITY—ALL MODELS

OPER. TEMP. UNIFORMITY

-65°C. ±.75°C.

+125°C. ±1.25°C.

+200°C. ±1.75°C.

SOLUTION:

BLUE M STABIL-THERM® LN₂ CONSTANT TEMPERATURE ENVIRONMENTAL CHAMBERS (also available for use with CO₂) (Top Opening)

These Blue M top opening chest type chambers provide a reliable, convenient means to conduct MIL tests at both high and low temperatures. Design helps retain low internal temperatures since cold tends to settle and remain at the bottom of the work chamber. These chambers are therefore recommended over the similar front opening models on the preceding page for applications where the door must be opened frequently.

Like the front opening chambers, these units can be used with either LN₂ or CO₂ but LN₂ is recommended. Cleaner, faster cooling, and more versatile LN₂ avoids the dry ice build-up inside the chamber common when CO₂ is used. LN₂ thus avoids defrosting which can limit test time. Operationally, these chambers perform well with either medium, and Blue M can furnish them for CO₂ use whenever LN₂ is not available.

A solid-state indicating control potentiometer (illustrated) regulates cooling with LN₂. Chambers have either solid-state electronic instrumentation or Blue M's Microtrol Control and Ready-Read temperature indicator with CO₂—depending upon the temperature range selected. A separate compartment houses all instrumentation.

These chambers are designed for maximum severity service. As the construction specifications show, they are rugged, quality-built units. They should not be confused with competitive chambers where performance is often sacrificed for price.

GENERAL SPECIFICATIONS

CONTROL SYSTEMS

SOLID-STATE INDICATING CONTROL—units with range from -185°C. to +200°C. (+392°F.) using LN₂, and units with range from -73°C. to +300°C. (+572°F.) using CO₂. Potentiometric design featuring advanced integrated circuitry and time proportioning. Illuminated direct read-out dial with 8" scale provides setting accuracy to within 0.5% of scale. Indication is 50% of span on either side of setpoint. Indication accuracy is ±1% of full scale. Appropriate Centigrade range standard, Fahrenheit available when specified at time of order.

BLUE M MICROTROL (Controlling Thermostat)—units with range from -73°C. to +204°C. (+400°F.) when using CO₂. Sensitive remote bulb type control. Uniform on-off differential. Dual scale in C. and F.

READY-READ TEMPERATURE INDICATOR—supplied when Microtrol Control is used. 3½" diameter. Stainless sensing bulb and matching scale.

BUILT-IN OVERTEMPERATURE PROTECTION (ALL MODELS)—solid-state instrument complements main control and conveniently installed adjacent to it. Features MAX-SET time-delay circuitry. Easily set. Positive protection at all times.

SEPARATE CONTROL COMPARTMENT—houses instrumentation, pilot lights and switches.

THERMOCOUPLES AND LEAD WIRE—included with all electronic instruments.

SOLENOID VALVE—especially designed for medium used in cooling.

MAIN SWITCH

PILOT LIGHTS

CONSTRUCTION

HOUSING—all-welded heavy gauge cold rolled steel, reinforced. Front of cabinet is 18-8 stainless.

WALLS—triple side walls.

INTERIOR—type 304, 18-8 stainless, heli-arc welded and passivated.

EXTERIOR FINISH—attractive blue enamel.

INSULATION—Marinite and Fiberglas.

DOOR—inside facing of stainless steel. Insulation same as unit. Chrome-plated hardware. Opens easily and closes firmly by means of heavy-duty counter-balancing spring assemblies at rear of unit.

ETHERNA HEATER BANKS—cylindrical type, assure years of service.

AIR CIRCULATION—quality ball bearing motor and balanced multi-bladed turbo blower designed especially for these units.

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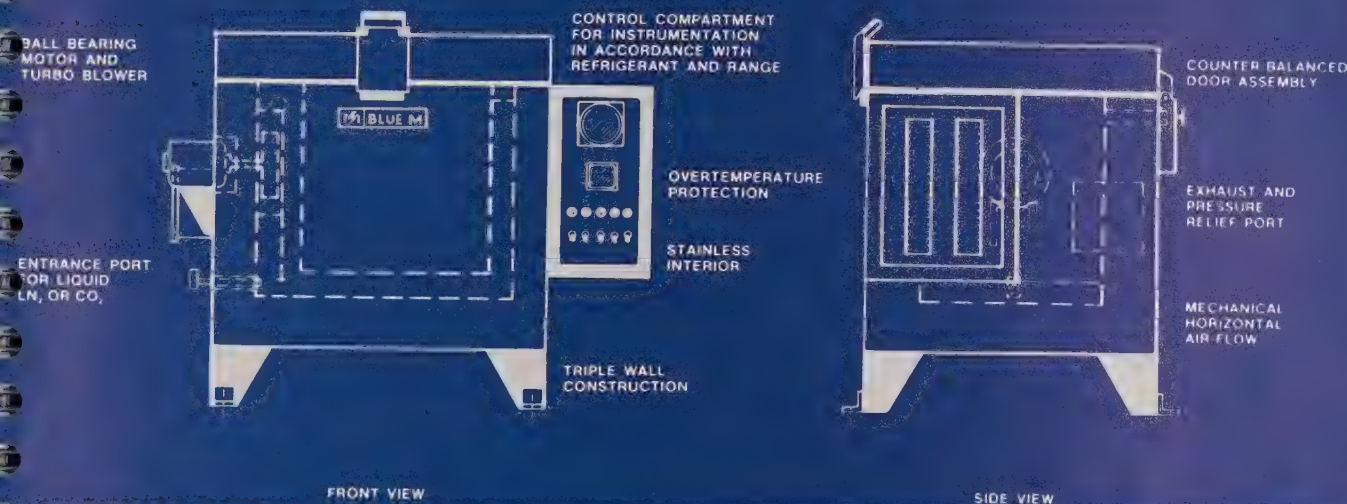
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SHELF—one, type 304, 18-8 stainless, adjustable; 8 positions for 25" x 20" x 20" size and 5 positions for 14" x 14" x 14" size.

AIR EXHAUST—adjustable.

OPERATION

Set control for desired temperature. In cooling, Liquid Nitrogen (or CO₂) is metered through a high quality solenoid valve designed especially for medium used. In heating, air is tempered by low-watt density shielded ETERNA element and propelled mechanically and horizontally for uniform heat distribution. NO RADIANT HEAT.

REFRIGERANT CONSUMPTION—LN₂ OR CO₂

The amount of refrigerant used for either size unit is contingent on many factors: (a) the number of times the door is opened and closed; (b) whether the blower is on or off; (c) orifice size; (d) load, etc. Engineering data regarding pull-down rate—temperature/time—is available on request for all sizes and refrigerants. As a preliminary guide, our tests indicate that the 5.8 cu. ft. size will require 8-10 lbs. of LN₂ to reach -185°C. with the door closed. Approximately 3 lbs. of LN₂ is used per hour to maintain -65°C. The 1.6 cu. ft. size will consume less than 100 lbs. of CO₂ per 8 hour day if the door is not opened and closed often.

GENERAL SPECIFICATIONS

LN₂

-185°C. to +200°C. (+392°F.)

Model Number	Inside Dimensions Inches (Cm.)			Overall Dimensions Inches (Cm.)			Total KVA	Voltage 60 Hz. A.C. 1 Phase	Cubic Feet Cap.
	W.	D.	H.	W.	D.	H.			
LNT-160C-1	14 (35)	14 (35)	14 (35)	36 1/2 (91)	27 (68)	44 (111)	2.4	*240V	1.6
LNT-270C-1	25 (63)	20 (51)	20 (51)	51 (128)	33 (84)	50 (126)	4.4	*240V	5.8

CO₂

-73°C. to +204°C. (+400°F.) (Blue M Microtrol)

COT-140A-1	14 (35)	14 (35)	14 (35)	36 1/2 (91)	27 (68)	44 (111)	1.5	120V	1.6
COT-250C-1	25 (63)	20 (51)	20 (51)	51 (128)	33 (84)	50 (126)	2.8	*240V	5.8

-73°C. to +300°C. (+572°F.) (Solid-State Instrumentation)

COT-160C-1	14 (35)	14 (35)	14 (35)	36 1/2 (91)	27 (68)	44 (111)	2.4	*240V	1.6
COT-270C-1	25 (63)	20 (51)	20 (51)	51 (128)	33 (84)	50 (126)	4.4	*240V	5.8

*Models also available for 208 V./1 Ph.

All wiring complete and enclosed to meet N.E. Code, as amended.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: MULTIPLE PANE GLASS OBSERVATION PANELS, EXTRA SHELVES, REMOVABLE BASKETS, INTERIOR LAMP AND SWITCH, SPECIAL FITTINGS, LEAD-IN PORTS, ELECTRICAL TERMINALS, RECORDING AND PROGRAMMING INSTRUMENTATION.

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Illinois, Blue Island 60406
Massachusetts, Framingham 01701
Michigan, Allen Park 48101
New York, Elmsford 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

APPLICATION:

How to achieve maximum efficiency, accuracy and peak performance for below ambient and above ambient temperatures at a fraction of the cost of expensive wide range environmental cabinets.

OPERATING AND CONTROL CHARACTERISTICS

TEMPERATURE RANGE

0° C. to +204° C. (+400° F.)

PULL-DOWN TIME (No Load)

See chart

RECOVERY TIME (No Load)

At +125° C., door open 15 seconds:
5 minutes

CONTROL ACCURACY: $\pm 0.5^{\circ}\text{C}$.

SETABILITY: $\pm 1.0^{\circ}\text{C}$.

REPEATABILITY: $\pm 0.5^{\circ}\text{C}$.

TYPICAL AIR TEMPERATURE UNIFORMITY

At +125° C.: $\pm 0.75^{\circ}\text{C}$.

BLUE M CERTIFICATION

All tests conducted with no load, no exhaust, and stabilized chamber under normal conditions of voltage and ambient. When unusual line voltages, ambients, severe loads and exhaust rates exist, please contact local sales offices or factory for recommendations.

BLUE M GUARANTEE

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operating requirements.

SOLUTION:

BLUE M TESTONIC CONSTANT TEMPERATURE ENVIRONMENTAL CABINETS

with ~~POWER-O-MATIC~~ ^{FAIRBANKS} ~~GO~~® Saturable Reactor Proportioning Control System and Versa-Kold Mechanical Refrigeration.

Blue M Testonic Constant Temperature Environmental Cabinets have been completely redesigned to improve and enhance their already superior operating performance. They feature Blue M's exclusive Versa-Kold Mechanical Refrigeration System, with cooling coil externally mounted and isolated from the work chamber. This location prevents condensation and keeps the chamber dry when rapid temperature transitions are made. The refrigeration system is never exposed to the possible damaging effects of exposure to elevated chamber temperatures. A new front mounted manual adjustable damper provides manual proportioning control to permit just the correct amount of cooling to maintain chamber temperature at desired level. By being isolated and unaffected by chamber temperature, the refrigeration system is in a constant state of readiness. Its full capacity—or any required part of it—is always on call to provide unusually rapid pull-down. Conversely, run-up time is also very rapid for a chamber of this broad temperature capability since heat is not wasted in bringing cooling equipment temperature up to chamber setpoint. A drain permits external water run-off whenever the refrigeration system is defrosted.

These mechanical convection horizontal air-flow cabinets bring a truly efficient, economical environmental test capability into the reach of any research or quality control department. Time-delay MAX-SET overtemperature protection and an elapsed time meter are now standard. Their outstanding performance enables scientists and designers to specify a reliable unit to fit specific requirements without the added cost of equipment with unnecessary flexibility. Units with broader temperature ranges to fit more diverse needs are described elsewhere in this catalog.

GENERAL SPECIFICATIONS

CONTROL SYSTEM

POWER-O-MATIC 60 Saturable Reactor Proportioning Control System.

MAX-SET™ OVERTEMPERATURE PROTECTION

MEMORY RING® Temperature Calibrating Dial.

DIAL POINTER LOCK

READY-READ TEMPERATURE INDICATOR— $\frac{3}{8}$ " diameter. Stainless sensing bulb. Dual scale in C. and F.

REFRIGERATION PRESSURE GAUGES

COMPRESSOR SWITCH

ELAPSED TIME METER

VOLTMETER

MAIN SWITCH

PILOT LIGHTS

CONSTRUCTION

HOUSING—all-welded heavy gauge cold rolled steel, reinforced.

INTERIOR—type 304, 18-8 stainless heli-arc welded.

EXTERIOR FINISH—attractive blue enamel.

INSULATION—Fiberglas.

DOOR(S)—same construction as unit. Two larger models have two doors, but no center mullion. Sili-cone rubber seal.

HARDWARE—exclusive adjustable no-slam, cam action latch and chrome-plated hinges.

ETERNA HEATER BANKS—cylindrical type, assure years of service.

AIR CIRCULATION—quality ball bearing motor and balanced multi-bladed turbo blower designed especially for these units.

SHELVES—two, wire rod, stainless steel, adjustable on 2" centers.

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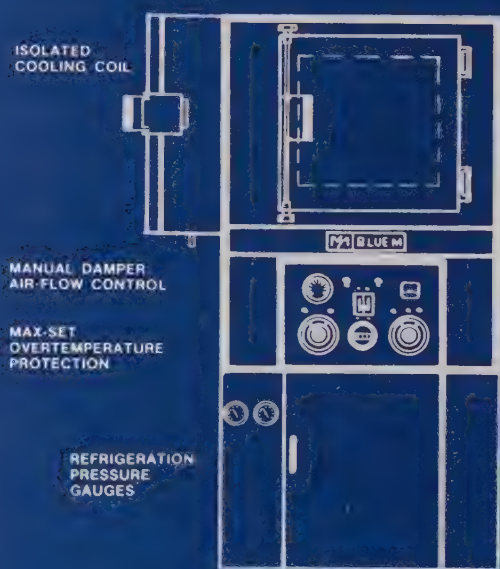
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FRONT VIEW

HELI-ARC WELDED STAINLESS INTERIOR

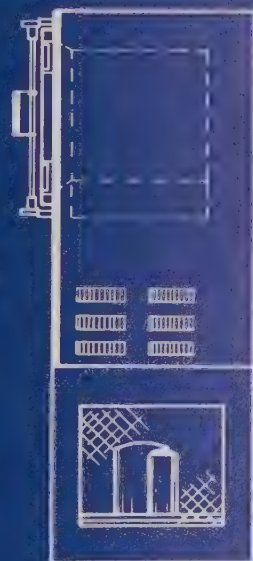
MECHANICAL HORIZONTAL AIR-FLOW

BLUE M POWER-O-MATIC 60 SATURABLE REACTOR PROPORTIONING CONTROL SYSTEM

ELAPSED TIME METER

READY-READ TEMPERATURE INDICATOR

BLUE M VERSA-KOLD MECHANICAL REFRIGERATION SYSTEM



SIDE VIEW

VERSA-KOLD MECHANICAL REFRIGERATION SYSTEM—single-stage, with extra large, heavy-duty, industrial type compressor. Rapid pull-down rate. Cooling coil installed in separate compartment at side of unit isolated from work chamber. Drain removes water when defrosting. Door provides ready access to refrigeration system.

AUTOMATIC PUMP-DOWN FEATURE—activated by separate thermostat set at $+70^{\circ}\text{C.}$ to $+80^{\circ}\text{C.}$ ($+176^{\circ}\text{F.}$). When chamber temperature reaches setting, refrigeration system is automatically pumped down to a low pressure. Eliminates compressor overheating and excessively high pressure.

OPERATION

Set control for desired temperature. In cooling, quality compressor quickly lowers temperature to required level . . . mechanical horizontal air-flow circulates cooled air uniformly.

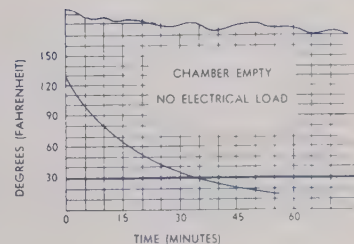
In heating, air heated by black heat, "controlled" low-watt density shielded ETERNA elements, is propelled mechanically and horizontally across working chamber for uniform heat distribution. Velocity proportioned up to 250 F.P.M. NO RADIANT HEAT.

TYPICAL PARTIAL CHART SHOWING RAPID COOL-DOWN CYCLE

Approximately 40% of rated capacity usable at 0°C. for removal of heat load generated by equipment under test.

To increase capacity when operating at elevated temperature, contact factory.

NOTES: Performance of cabinets based on $+90^{\circ}\text{F.}$ room temperature. Uniformity and control points shown are with empty chamber. Introduction of auxiliary loads alters control point and uniformity slightly.



GENERAL SPECIFICATIONS

Model Number	Inside Dimensions Inches (Cm.)			Overall Dimensions Inches (Cm.)			Total KVA	Voltage 60Hz. A.C. 1 Phase	Cubic Feet Cap.
	W.	D.	H.	W.	D.	H.			
E-2504C-1	25 (63)	20 (51)	20 (51)	50 (127)	32 (80)	69 (175)	5.7	240V.	5.80
E-4804C-1	48 (120)	24 (61)	36 (90)	73 (185)	36 (90)	73 (185)	11.4	240V	24.0

Other voltage available all models: 208V./1Ph.

All wiring complete and enclosed to meet N.E. Code, as amended.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: GLASS OBSERVATION PANELS, INTERIOR LAMP AND SWITCH, LEAD-IN PORTS, ELECTRICAL TERMINALS, INDICATORS, RECORDING, ETC.

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BLUE M SHOCK TEST CHAMBERS

The Blue M test chambers described in this section have been designed and engineered to meet definite needs. As the unit descriptions indicate, these requirements include specific sections of MIL. STD. 202D and MIL. STD. 883. These sections are reproduced in their entirety on pages 192-196. These chambers are also capable of meeting in-house specifications of companies testing commercial components and products. Certain modifications are available if the standard design falls short of your needs. In the relatively short time since their introduction, these Blue M units have become the recognized standard of quality and reliability wherever thermal shock testing facilities are used. Impartial recognition studies of manufacturers of this equipment continue to verify Blue M's leadership in this exacting field. There are several excellent reasons why:

OUTSTANDING PERFORMANCE: The heating portion of the thermal cycle is regulated by a patented, fully proportional control of Blue M's own manufacture. This type of control provides fully automatic, true straight-line, infinitely proportional performance equal to that achieved only with costly (and complicated) potentiometer instrumentation. Yet the simplicity of these exclusive Blue M controls has made their operational reliability a legend throughout the testing community.

Where necessary, these standard, proven controls have been modified to fulfill the particularly demanding requirement of these specialized chambers. For example, the Blue M Dual Thermal Shock Test Cabinets described on the following pages are equipped with a special solid-state proportioning control of Blue M's own patent and manufacture. Similar to the control described in detail on pages 22 and 23 and offering the same fine operating characteristics, it has been redesigned expressly to provide the greater speed and response sensitivity required by thermal shock chamber operation. This kind of performance is not required by conventional chambers.

The cooling portion of the test cycle is simply and efficiently controlled through the use of quality solid-state instrumentation. Specially designed solenoid valves meter LN₂ precisely to assure the required cooling effect with a lesser expenditure of cooling medium.

It should be pointed out that these cabinets are not intended for long-term steady-state operation at low temperatures. They have been designed to reach and hold low temperatures only briefly as part of a thermal cycle. If your requirements call for steady-state cold operation over a prolonged period, we recommend our Versa-Range® or Stabil-Therm® LN₂/CO₂ Cabinets described in this catalog.

SOUND, CREATIVE ENGINEERING: These chambers have been designed in most cases to meet certain definite test requirements. That they DO meet them goes without saying. But well worth considering are features which have been engineered into these units to make their performance and operation superior to any competitive equipment on the market.

One example is Blue M's dry nitrogen feed system. When a workload is suddenly transferred from an extremely cold into a very hot environment, condensation and oxidation often occur. Not only can this cause possible workload damage, but it can also establish false test conditions with equally false test results. Blue M's dry nitrogen feed system enables the heated environmental chamber to be purged of oxygen as desired. This effectively limits condensation and oxidation and permits testing to be conducted under truly controlled conditions.

QUALITY CONSTRUCTION: This expression is so commonly used that it tends to lose significance. After all, no manufacturer will ever admit to building inferior chambers. But they ARE built, they ARE sold—and everyone knows it. Everyone also knows that they AREN'T built by Blue M.

Blue M Thermal Shock Test Chambers are constructed of quality materials and components. Every step of manufacture is carefully supervised. Every unit is carefully inspected and thoroughly tested before shipment. Every chamber is backed by the integrity of the country's leading manufacturer of thermal shock test equipment. We encourage any prospective purchaser of such facilities to either make a plant visit to see this equipment or to visit an operating installation to see it actually at work. One such inspection is worth much more than a whole dictionary of descriptive adjectives.

ECONOMY: Blue M Thermal Shock Test Cabinets are not sparingly designed, but they are economical. First of all, they DO meet the specifications for which they are designed, and they meet them without costly attention by you. They do not require constant operator supervision and maintenance. They can be put into operation immediately after delivery, and they WILL operate as specified. There are no "extras" to add later.

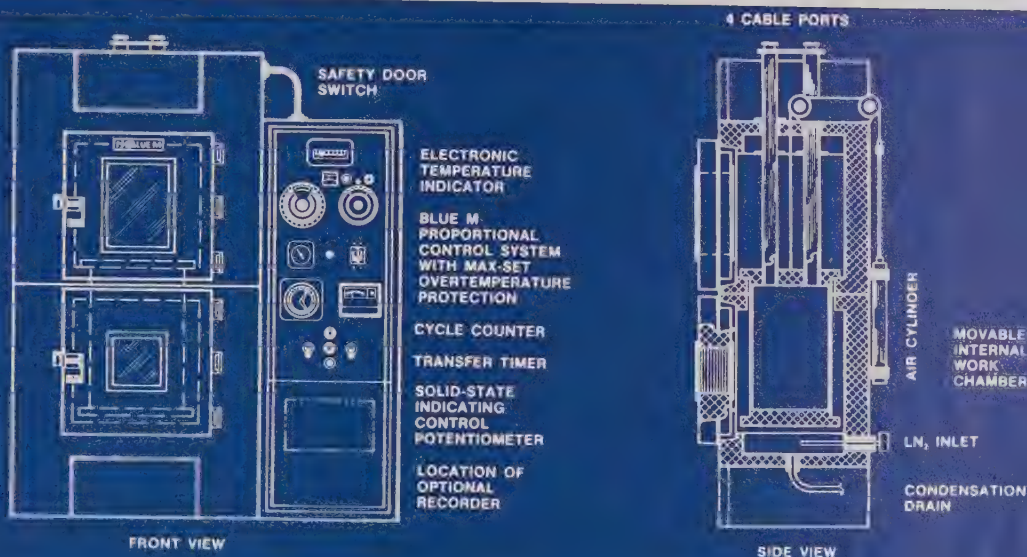
Blue M Thermal Shock Test Cabinets are reliable. They do not "overtest" your components, eliminating the possibility of unnecessary redesign . . . they do not "undertest" your components, eliminating a possible cause of later rejection. Equally important, their operational reliability includes built-in safeguards that aid in the protection from possible costly damage or loss of valuable workloads which often cost more than the chamber itself.

Finally, Blue M Thermal Shock Cabinets are individually applied. Units are sold only after consultation between you and Blue M determines exactly what your requirements are and that the cabinet will, indeed, do the job you expect. And every Blue M Thermal Shock Cabinet is backed by a nation-wide organization to lend whatever post-installation assistance you may need.

Please note that two other kinds of Blue M units are suitable for shock test applications, but are not included in this section. One type is the Stabil-Therm LN₂/CO₂ Chambers in the Refrigerated Test Chamber section—pages 60-63. The second type is the series of Versa-Whirl Baths in the Bath section—pages 158-161. These latter units have been designed specifically to meet Mil. Std. 883, Method 1011, Conditions A to F as well as severe in-house test specifications.

APPLICATION: How to conduct thermal shock tests to MIL. STD. 202D, Method 107C, Conditions A, B, C & F, and MIL. STD. 883, Method 1010, Conditions A, B., C & D to determine the resistance of a part when exposed to extremely low and high temperatures.

SOLUTION: BLUE M DUAL THERMAL SHOCK TEST CABINETS



These units have been designed specifically to meet the requirements of the indicated military specifications as well as any in-house specifications which come within the broad capabilities of these chambers.

They consist of separate hot and cold chambers, each with its own control system and mechanical horizontal air-flow system. A movable work chamber is automatically transferred from one to the other in accordance with the operating specifications. This chamber is 14" W. x 14" D. x 19" H. (2.3 cu. ft.), of all-welded Type 304, 18-8 stainless with one or more adjustable stainless shelves or baskets. Weight of test specimen is limited to a maximum of 30 pounds (steel) for MIL. STD. 202D and equivalent of 15 pounds for MIL. STD. 883.

The lower cold chamber employs LN₂ to reduce the incoming part to -55°C. or -65°C. within the required time/temperature tolerance. It is under control of a solid-state indicating control potentiometer, special solenoid valves, inlet pipe and pressure relief valve. The upper heat chamber utilizes Blue M's fully proportional control which raises temperature within the required time and tolerance. Built-in MAX-SET overtemperature protection aids in safeguarding equipment and workload.

Work chamber transfer is accomplished smoothly through an adjustable transfer timer which controls an air solenoid valve and air cylinder. Movement up or down is held in alignment through four stainless steel tubes and self-sealing apertures. Direct electrical connections to the part being tested are made through these tubes with the wiring harness moving with the chamber transfer. Timer adjusts to permit cycle time to be varied from 2½ to 150 minutes in each chamber.

A dry nitrogen feed system facilitates purging of oxygen in the heat chamber. This prevents condensation on the workload as it enters the chamber in a chilled condition, and also avoids oxidation of metal parts of the workload. For safety, opening the door automatically shuts off power to the entire unit, and drives the work carriage up to the top chamber. It remains there until the door switch is depressed manually. This avoids an unwarranted carriage transfer.

It should be noted that these units are designed for thermal shock and thermal cycling to the applicable military specifications, and are not intended for continuous steady state use. Units for such service are to be found elsewhere in this catalog.

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Massachusetts, Framingham 01701
Michigan, Allen Park 48101
New York, Elmsford 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

OPERATING AND CONTROL CHARACTERISTICS

TEMPERATURE RANGE

-75°C. to +200°C. (+392°F.)

AIR SUPPLY RECOVERY TIME:

2 Minutes

LN₂ CONSUMPTION

(Chamber Empty)

Pull Down: 15 lbs.

Steady State: 26 lbs./hr.

10 Minute Pre-Purge: 13 lbs.

(Chamber with Rated Load)

Pull Down: 25 lbs.

Steady State: 26 lbs./hr.

10 Minute Pre-Purge: 13 lbs.

COOLING STABILIZATION TIME

(Chamber Empty)

10 Minutes

(Chamber with Rated Load)

16 Minutes

HEATING STABILIZATION TIME

(Chamber Empty)

8 Minutes

(Chamber with Rated Load)

23 Minutes

TRANSFER TIME

10 Seconds

MIL.-STD. 202D METHOD 107C THERMAL SHOCK

MIL-STD. 202D METHOD 107C THERMAL SHOCK										
	TEST CONDITION A			TEST CONDITION B			TEST CONDITION C		TEST CONDITION F	
Step	Temp. °C.	Time (Min.)	Temp. °C.	Time (Min.)	Temp. °C.	Time (Min.)	Temp. °C.	Time (Min.)	Temp. °C.	Time (Min.)
1	55	+0 -3 (See Table below)	-65	+0 -5 (See Table below)	-65	+0 -5 (See Table below)	-65	+0 -5 (See Table below)	-65	+0 -5 (See Table below)
2	25	+10 -5 5 Max.	25	+10 -5 5 Max.	25	+10 -5 5 Max.	25	+10 -5 5 Max.	25	+10 -5 5 Max.
3	85	+3 -0 (See Table below)	125	+3 -0 (See Table below)	200	+5 -0 (See Table below)	150	+3 -0 (See Table below)		
4	25	+10 -5 5 Max.	25	+10 -5 5 Max.	25	+10 -5 5 Max.	25	+10 -5 5 Max.	25	+10 -5 5 Max.

EXPOSURE TIME AT TEMPERATURE EXTREMES (MIL. STD. 202D ONLY)

SPECIMEN WT. (LBS.)

0.3 and below

above 0.3 to 3 incl.

above 3 to 30 incl.

MIN. TIME, STEPS 1 & 3 (HRS.)

1/2

1

2

NOTES

- 1. PRODUCT LOAD.** It is recommended all data including type of load material, weight, size and exposed surface areas, and trays, baskets, fixtures, etc. be submitted to factory for confirming load capacity of each test condition. Ideally, a complete product load with fixturing should be factory performance-tested.
- 2. AIR TEMPERATURE MEASUREMENT.** Performance tests are based on supply air temperature measured at conditioned air discharge point prior to passing over product load.
- 3. +25°C. DWELL TIME.** Test steps 2 and 4 state the effective total transfer time from specified low to high temperature, or the reverse, shall not exceed 5 minutes. Minimum transfer time is not specified. Transfer times in this dual chamber will be in the order of 2 to 3 seconds.

GENERAL SPECIFICATIONS

CONTROL SYSTEM

(HEAT CHAMBER)

BLUE M Solid-State Proportioning Control System

MEMORY RING® Temperature Calibrating Dial

DIAL POINTER LOCK

MAX-SET™ OVERTEMPERATURE PROTECTION

ELECTRONIC TEMPERATURE INDICATOR/THERMOCOUPLE

CYCLE COUNTER

VOLTMETER

MAIN CIRCUIT BREAKER

PILOT LIGHTS

(COLD CHAMBER)

SOLID-STATE INDICATING CONTROL POTENTIOMETER/THERMOCOUPLE

QUALITY LN₂ SOLENOID VALVE AND INJECTION SYSTEM*

ADJUSTABLE TRANSFER TIMER AND SWITCH

(From 2½ minutes minimum to 150 minutes maximum.)

LN₂ BY-PASS SWITCH

PILOT LIGHTS

*Designed for 30 P.S.I. LN₂ supply pressure. Units modified for 300 P.S.I. CO₂ available. Please contact factory.

CONSTRUCTION

(HEAT CHAMBER)

HOUSING—all-welded heavy gauge cold rolled steel, reinforced.

INTERIOR—type 304, 18-8 stainless; all interior seams heli-arc welded tight.

EXTERIOR FINISH—attractive blue enamel.

INSULATION—Fiberglass.

DOOR—all stainless. Chrome-plated hardware. Cam-type latches. Silicone rubber seals.

DOUBLE GLASS OBSERVATION PANEL—9¼" W. x 12¾" H.

ETERNA HEATER BANKS—cylindrical type, assure years of service.

AIR CIRCULATION—quality ball bearing motor and balanced multi-bladed blower designed especially for these units. Horizontal air-flow.

AIR INTAKE—adjustable.

AIR EXHAUST—adjustable.

INLET PORT—½" stainless pipe to blower inlet for dry nitrogen introduction as required.

(COLD CHAMBER)

Basic construction details similar to those shown for Heat Chamber except with provisions for LN₂ introduction and control. Has multipane, 10" x 10" glass observation panel centered in door.

MOVABLE WORK CHAMBER—14" W. x 14" D. x 19" H. Type 304, 18-8 stainless. Open sides for

EQUIPMENT COVERED BY
OUR
EXCLUSIVE

PARTS
WARRANTY
and
REPLACEMENT
SERVICE
PROGRAM



BLUE M

MIL-STD. 883A METHOD 1010.1 TEMPERATURE CYCLING

Step	TEST CONDITION A			TEST CONDITION B			TEST CONDITION C			TEST CONDITION D		
	Temp. °C.	Time (Min.)		Temp. °C.	Time (Min.)		Temp. °C.	Time (Min.)		Temp. °C.	Time (Min.)	
1	-55	+0 -5	10 Min.	-55	+0 -5	10 Min.	-65	+0 -5	10 Min.	-65	+0 -5	10 Min.
2	25	+10 -5	5 Max.	25	+10 -5	5 Max.	25	+10 -5	5 Max.	25	+10 -5	5 Max.
3	85	+3 -0	10 Min.	125	+3 -0	10 Min.	150	+5 -5	10 Min.	200	+5 -0	10 Min.
4	25	+10 -5	5 Max.	25	+10 -5	5 Max.	25	+10 -5	5 Max.	25	+10 -5	5 Max.

EXPOSURE TIME AT TEMPERATURE EXTREMES (MIL. STD. 883 ONLY)

Time at high and low temperatures utilizing approximately 12" of the movable chamber height shall be sufficient to stabilize load at specified temperature. If fixtures or other factors make 10 minutes inadequate for stabilization, time at temperature extremes shall be increased as required.

4. NUMBER OF TEST CYCLES. This varies considerably with the specification. MIL. STD. 202D, Method 107C varies from a minimum of 5 to a maximum of 100 cycles, depending on specified test condition. MIL. STD. 883, Method 1010 requires 10 cycles.

MIL. STD. 883, Method 1010 requires load temperature stabilization to specified temperature conditions. Times at each extreme must be sufficient to meet this requirement. This is a 100% acceptance test. MIL. STD. 202D-107C requires only a specified minimum hold time at each extreme and does not require load thermal stability. It is not a 100% acceptance test. Applicable sections of these Standards appear on pages 192-196.

maximum air-flow over specimen. One adjustable stainless wire rod shelf.

CABLE PORTS—four, 2" O.D. stainless steel. Move with internal chamber and maintain alignment. Direct electrical connections to part tested can be made through them. Port apertures in heat chamber capped against heat loss.

CONSOLE INSTRUMENT CABINET—houses controls, instrumentation, and switches. Rear access door with safety lock.

OPERATION

(HEATING) TEMPERATURE RANGE:

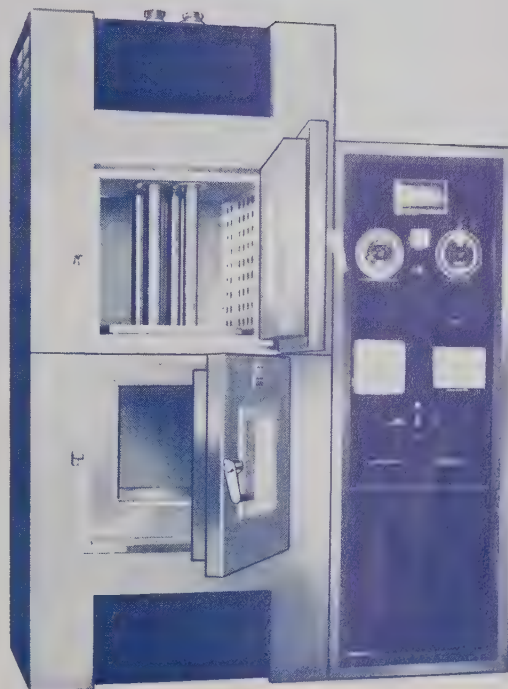
+50°C. to +200°C. (+392°F.)

Set control to desired temperature. Air, heated by black heat, "controlled" low-watt density shielded ETERNA elements, propelled mechanically and horizontally across working chamber for uniform heat distribution. Velocity proportioned up to 250 F.P.M. NO RADIANT HEAT.

(COOLING) TEMPERATURE RANGE:

AMBIENT TO -75°C.

After the part has been heated to proper temperature for the required specified time, transfer timer automatically activates solenoid valve and air cylinder to smoothly lower inner chamber into cold chamber. Solid-state control system and transfer timer regulates LN₂ input to drop temperature to required level. Mechanical convection, horizontal air-flow system assures uniform distribution of cold throughout chamber and over workload. Timer allows maximum cycle time of 150 minutes in each chamber. Cycle counter automatically shuts off unit after pre-selected number of cycles.



GENERAL SPECIFICATIONS

Model Number	*Inside Dimensions Inches (Cm.)			**Overall Dimensions Inches (Cm.)			Total KVA	Voltage 60 Hz. A.C. 1 Phase	Cubic Feet Cap.
	W.	D.	H.	W.	D.	H.			
WSP-109B-3	14 (35)	14 (35)	19 (48)	63 (159)	34 (86)	85 (216)	15.7	208 V.	2.3
WSP-109C-3	14 (35)	14 (35)	19 (48)	63 (159)	34 (86)	85 (216)	15.7	240 V.	2.3
WSP-109D-3	14 (35)	14 (35)	19 (48)	63 (159)	34 (86)	85 (216)	15.7	480 V.	2.3

*Access area for loading at top is 16" H. and 14 3/4" H. at bottom. Width and depth are each 14".

**Overall height with chamber in UP position is 105". (264 Cm.)

All wiring complete and enclosed to meet N.E. Code, as amended.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: MULTI-POINT STRIP CHART RECORDER; EXTRA SHELVES; BASKETS; CASTERS.

SEND FOR ADDITIONAL INFORMATION AND ALL PRICES

BLUE M EQUIPMENT

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California, Sunnyvale 94086
Florida, Orlando 32789
Georgia, Atlanta 30341

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BLUE M OVENS

The Blue M Ovens pictured and described in this section cover a uniquely broad range of applications—everything from mass production equipment to units designed specifically to meet certain life-test or research requirements. As such they provide the production and research specialist interested in quality equipment with a true showcase of advanced engineering concepts. Highlighting these are the various FRICTION-AIRE™ Ovens on pages 72-79. Absolutely unique in concept and design, these remarkable chambers are the only electric ovens ever built with no heating elements. Moving air is the only source of heat. They offer a number of truly revolutionary operational and performance characteristics well worth reading about—including the patented non-electric POWER-O-MATIC 90™ Control System that provides 100% proportional performance.

Many units in this section are equipped with the patented POWER-O-MATIC 60® Saturable Reactor Proportioning Control System. To the user of an oven, this proven system provides a degree of temperature control and uniformity that more than meets the strictest reliability standards. Literally thousands of these control systems in ovens of all sizes and descriptions have been operating for years without a hint of failure. A detailed description of this control system appears on pages 14-17.

This same reliability is inherent in those ovens equipped with the Blue M POWER-O-MATIC 60 Saturable Reactor Programmer-Controller. This non-cycling, cam-type system enables oven temperatures to be regulated to virtually any desired program with an accuracy limited only by the accuracy of the cam. This system is described on pages 18-19.

Other ovens in this section are equipped with the Blue M's patented POWER-O-MATIC 70® Solid-State Proportioning Control System. This development, described on pages 22 and 23, provides true straight-line, infinitely proportional performance at a cost significantly lower than might be expected for equipment with such remarkable operational characteristics.

Still other ovens feature Blue M's newest control system, the patented POWER-O-MATIC 80™ Silicon Controlled Rectifier (SCR) Solid-State Proportioning Control System described on pages 24 and 25. Units with this system are Blue M's finest high temperature chambers, and have been developed expressly to meet extremely difficult applications.

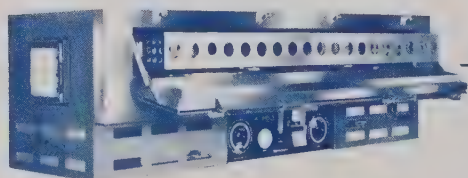
With these various control systems as a nucleus, it has been possible to engineer ovens to do special jobs . . . to concentrate

on function, rather than on operation. It hasn't been necessary to be concerned with whether or not any given unit or design would work. These control systems (and our unique ability to apply them exclusively to our own chambers) automatically makes sure that every unit does work as specified. We guarantee it! Accordingly, Blue M today has an unmatched selection of ovens from which to choose—as well as an unequalled ability to custom-design units to fit special applications. Regardless of your oven requirements, Blue M can meet it.

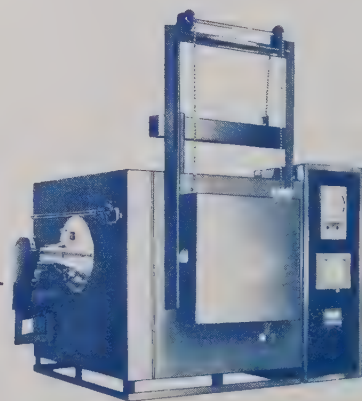
You will note that all Blue M Ovens include standard features which other manufacturers classify as options (and charge for), or do not have available at all. Built-in overtemperature protection, stainless interiors, quality temperature indicators, and even recorders are standard on many models. Elapsed time meters offer convincing proof that Blue M equipment can log thousands upon thousands of operational hours without failure. In short, Blue M doesn't just build ordinary ovens. They're the finest ovens ever made . . . easily the finest you can buy.

As the Section Index at the right shows, we have arranged the ovens on the following pages by types. This will make selection of the unit you need easier. Also, similar ovens of the same basic type are grouped together—the more common, standard units appearing first with the more specialized models appearing later. Please note that certain special-interest units—notably our Inert Gas Ovens—have an introduction of their own. If you have an interest in this type of oven, we urge you to read this material carefully. It has been prepared to help answer many common questions, and to aid in proper unit selection.

All the units on the following pages are merely representative examples of Blue M's complete oven design/manufacturing ability. There are literally dozens more which could be included. If the unit you need isn't shown, we suggest you outline your requirements to your nearest Blue M branch office or contact us direct. Very possibly we have already built the exact oven you need—or can engineer it for you—quickly and at surprisingly low cost.



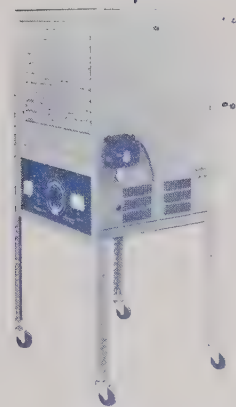
QUARTZ TUBE DRYING OVEN



LARGE ANNEALING OVEN

INDEX

OVEN TYPE	PAGES
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Temp-O-Loy-Ovens	140-141
Photoelasticity Ovens	142-143
Modifications of Standard Horizontal Air-Flow Patterns for Specialized Work	144-145

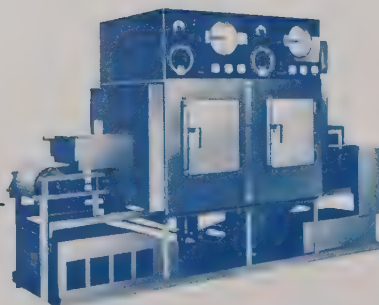


PRINTED CIRCUIT
BOARD SOAKING
OVEN

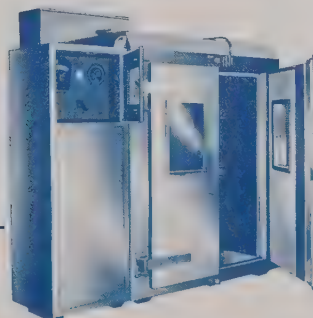


SPECIAL CONVEYOR OVEN

FRICTION-AIRE
BATCH OVEN



SPECIAL TWO-CELL CONVEYOR OVEN



SPECIAL BATCH OVEN

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When Blue M introduced the revolutionary FRICTION-AIRE Oven, it was immediately acclaimed as "one of the 100 most significant technical products of the year" by the prestigious Industrial Research magazine. In a special Business Week magazine feature article on the unit, FRICTION-AIRE was called: "... the only real innovation in such ovens since they were first made 50 years ago."

Described here are FRICTION-AIRE's operation, and some chief advantages in detail. As you review them, you'll immediately see that this remarkable development has virtually unlimited application in industries of all kinds: chemical, petroleum, arsenals, electronics, paints... for hazardous work, for exacting testing/processing, for general utility work, for drying, aging, life-testing.

At present, there are several Blue M Ovens utilizing this unique concept—including those on the following pages. More are planned. If these data suggest how FRICTION-AIRE might help you, write us outlining your general specifications and requirements. Very probably we can show you how "the only real innovation" in electric ovens in two generations can be put to work for you.

APPLICATION: How to be assured of maximum safety while testing/processing hazardous materials to critical standards; drying of parts previously cleaned in solvents such as printed circuit boards, parts prior to plating, etc.

SOLUTION:
BLUE M

FRICTION-AIRETM
PATENTED

with **POWEROMATIC-90**TM non-electric proportioning control system
and non-electric overtemperature protection

THE ELECTRIC OVENS WITH NO HEATING ELEMENTS

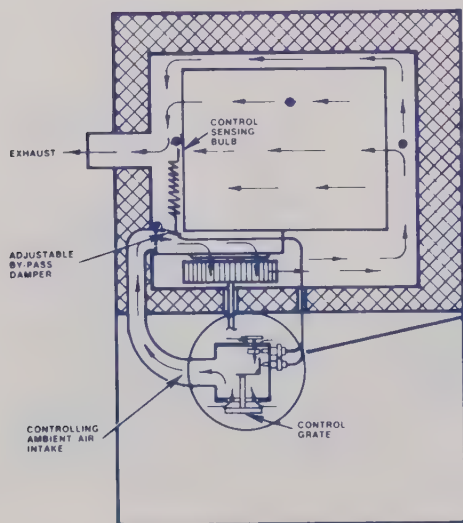
A MAJOR BREAKTHROUGH IN THE ART OF GENERATING AND CONTROLLING ENVIRONMENTAL HEAT

EXPANDED LINE EMPLOYING UNIQUE DESIGN CONCEPT INCLUDES BENCH, FLOOR AND BATCH TYPES... CLASS A AND CLASS 1, GROUP D (3 MODELS U.L. LISTED!)... TEMPERATURES TO +260°C. (+500°F.)

The application of the revolutionary FRICTION-AIRE principle to the variety of different chambers described in detail on the following pages enables the test or processing specialist to select a facility that meets his operating parameters exactly. There are 13 models in all ranging in size from small 1.3 cubic-foot bench ovens on up to large batch type chambers of 92 cubic-foot capacity. Depending on their primary application, these ovens have temperature ranges to +150°C. (+302°F.), +204°C. (+400°F.) and +260°C. (+500°F.).

Yet regardless of their size, configuration or range, all have inherent safety as a fundamental characteristic. This is emphasized by the Class 1, Group D chambers described on pages 74 and 75 which include three models U.L. Listed for such hazardous work—the only electric ovens ever so listed.

HERE'S HOW IT WORKS



BUILT-IN OVERTEMPERATURE PROTECTION

Unique intrinsically safe non-electrical system powered by its own secondary bellows and responding to its own sensing bulb. A spring-loaded vent with inlet area greater than control vent area is latch-closed by reset lever on control panel. If main control fails, OTP safety sensing bellows trips vent latching mechanism to lock vent in fully open position. Resulting increase in exhaust capacity immediately drops chamber temperature. Vent must be re-closed by manually pressing reset lever. Oven continues operation at safe temperature.

CONTROL OPERATION

Control is a temperature-sensitive bellows regulating a fresh air inlet to blower wheel. Desired temperature is set by control dial. Control grate is closed. As temperature rises with blower operation, bellows expand to open and position grate. More air enters the system, causing sharp temperature curve-off and stabilization.

Adjustable by-pass damper vane establishes control inlet pressure. When horizontal, damper restricts path of blower only through control. Since this reduces CFM and velocity, heating is minimized for control at lower temperatures. When damper is vertical, system recirculates at maximum for maximum heat.

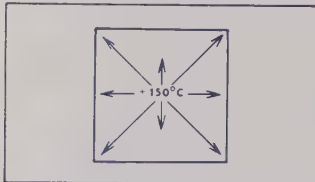
While a large air volume must be moved to generate heat, much of it passes through a by-pass chamber surrounding the work chamber. The small percentage passing through the inner chamber is practical for most applications.

HERE'S WHAT IT DOES

FRICION-AIRE gives you a controlled environment with 100% straight-line proportional temperature performance WITHOUT HEATING ELEMENTS... WITHOUT ELECTRICAL CONTROLS.

Its principle of operation is simple; Blue M has harnessed the law of the Conservation of Energy as set forth by Dr. James P. Joule. In essence, this states that the energy required to set air in motion must appear as heat. By utilizing a high velocity air flow system to move a large volume of air through a prescribed pattern, Blue M has developed a unique environmental chamber with a number of remarkable advantages:

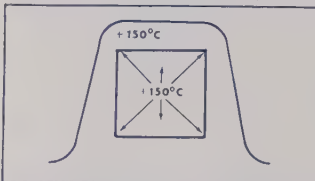
1. There is no central heat source in the system. The blower simply sets the air in motion. It is not operating at temperatures higher than the circulated air or any other part of the chamber. Heat is generated directly within the air itself due to its turbulence and friction as it moves. And, as a result...



NO POINT IN THIS OVEN CAN EXCEED THE INDICATED AIR TEMPERATURE.

If the external temperature indicator registers +150°C. inside the chamber, it is +150°C. (within $\pm 1^\circ\text{C}$.) at all points inside the chamber. There are no hot spots, and no cold ones.

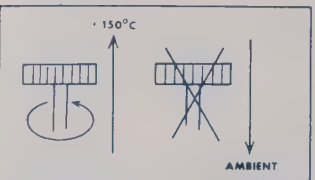
2. Since air movement alone provides heat and since the gradually heating air completely fills the chamber, there are no heat zones and no temperature stratification. As a result...



AIR TEMPERATURE RISES SIMULTANEOUSLY IN ALL PORTIONS OF THE CHAMBER.

If a time lag or differential exists, it is extremely small and very difficult to measure.

3. Heat is generated solely by the operation of the motor. As a result...



THERE IS A NATURAL INTERLOCK OF BLOWER AND HEAT.

This inherent safety characteristic means that even in the unlikely event of failure of the motor blower system—the only source of heat—chamber temperature will automatically drop. You cannot experience potentially dangerous temperature run-away. Also, should air circulation stop, there is no uncontrolled resistance element rapidly heating to a point above the auto-ignition point of the workload because air is no longer passing over it. And there is no need for a timed purge cycle to remove the hazardous environment resulting from high evaporation of volatiles from the workload when it is first placed in the chamber.

These remarkable characteristics make FRICION-AIRE inherently safe—have enabled some units to be listed by Underwriters' Laboratories for Class 1, Group D service! But besides safety, FRICION-AIRE offers a number of other advantages well worth remembering the next time you need an oven

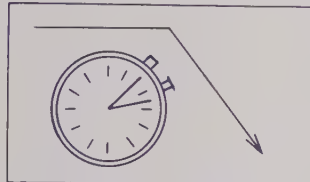
4. FRICION-AIRE has no signal-creating electronic components such as switches and power contacts. As a result...



OPERATION IS FREE OF RFI.

This is important to anyone concerned with life-test work in conjunction with extremely sensitive instrumentation.

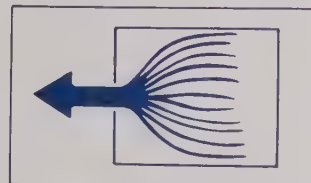
5. While FRICION-AIRE has a high velocity blower system, the air velocity within the work chamber is fully controllable and is reduced to a practical velocity. As a result...



FAST COOL-DOWN RATES ARE AN INHERENT CAPABILITY

Typically, empty oven temperature drops from +150°C. to +50°C. in 30 minutes.

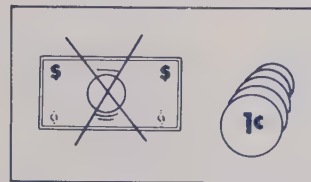
6. Also as a result of this controllable high velocity blower system...



MUCH LARGER ELECTRICAL LOADS CAN BE DISSIPATED THAN IS POSSIBLE IN CONVENTIONAL OVENS.

This also assures a much greater temperature uniformity when handling a large number of heat dissipating components.

7. FRICION-AIRE automatically regulates the precise amount of exhaust to balance the input of heat generated by the load. As a result...



OPERATION IS EXTREMELY ECONOMICAL

FRICION-AIRE avoids the need, common in conventional ovens, to set up an artificial heat loss by the exhaust rate, and overcoming this with additional heat over and above that generated by the load. Power savings can be significant—particularly in multiple FRICION-AIRE installations.

8. FRICION-AIRE is simple—unbelievably so. An absolute minimum number of parts can go wrong. As a result...



MAINTENANCE IS PRACTICALLY NON-EXISTENT

If ever any FRICION-AIRE part should fail, chances are excellent that your own personnel can repair or replace it—quickly, easily, and economically

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APPLICATION:

How to be assured of maximum safety while testing/processing hazardous materials to critical standards—in small amounts or in volume.

As the description on the previous pages indicates, FRICTION-AIRE is ideally suited for several "problem" applications. The most obvious is testing/processing hazardous materials in ordnance/munitions installations, as well as paints, solvents, lacquers and similar products. Conventional electric hazard-safe chambers with heating elements have an inherent hot spot in them—a potential danger no amount of engineering by the manufacturer or care by the user can eliminate.

FRICTION-AIRE does. There is no central heat source... no area where temperature can exceed desired operating level. Even spillage of flammables inside is not dangerous since any surface they touch is only as hot as the interior environment.

Amplifying this: tests show load temperature follows very closely behind chamber temperature. In fact, the load is heated as efficiently as in conventional chambers with greater K.W. If requirements call for processing hazardous materials over extended periods, load and chamber temperature will be equal practically all this time. Chamber and load reach equilibrium and stay that way indefinitely until operating temperature is deliberately changed. Should spillage occur, the spilled material is at the same temperature as any point it can touch.

Clearly, you cannot specify a safer chamber than FRICTION-AIRE.

The importance of this with the increasing emphasis on safety by such regulatory bodies as OSHA is self-evident. We are primarily concerned with two categories of OSHA: (1) Sub-Part S, concerning electrical devices in hazardous atmospheres and covered by N.E. Code, as amended. FRICTION-AIRE Ovens are built to the recommendations of this Code. (2) Sub-Part H, concerning hazardous internal chamber conditions. The inherent FRICTION-AIRE design overcomes many of the safety requirements of this part of NFPA Bulletin 86A and is built to the recommendations of those remaining.

SOLUTION:

BLUE M

FRICTION-AIRE TM
PATENTED

CLASS 1, GROUP D OVENS

with **POWER-MATIC** TM non-electric proportioning control system and non-electric overtemperature protection

3 DISTINCT TYPES—EACH DESIGNED FOR SPECIFIC WORK—INCLUDING 3 MODELS U.L. LISTED FOR CLASS 1, GROUP D!

When Blue M introduced FRICTION-AIRE it was immediately evident that safety would be one of its chief attributes. It was only with experience gained through testing and field service that the degree of safety provided by the concept could be evaluated. The Class 1, Group D chambers presented here—particularly those U.L. Listed for this service, the only electric ovens ever so listed—are a true measure of the inherently safe nature of FRICTION-AIRE.



15°C. ABOVE AMBIENT TO +150°C. (+302°F.)—U.L. LISTED

The first electric ovens U.L. Listed for Class 1, Group D work and for operation in Class 1, Group D areas. Remains well under +215°C. under any operating conditions, eliminating need for special auxiliary overtemperature protection devices. HS-1002EFG SERIES.

15°C. ABOVE AMBIENT TO +260°C. (+500°F.)

Three models similar to those above but designed specifically for hazardous applications requiring higher temperatures. HS-1004-1EFG Series.

15°C. ABOVE AMBIENT TO +150°C. (+302°F.)—BATCH CONFIGURATION

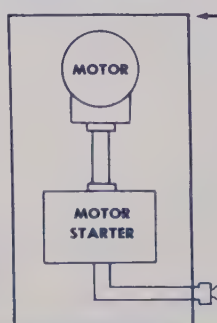
Designed especially for volume test/processing of hazardous materials, drying of parts cleaned in solvents such as printed circuit boards, and similar work. MODEL HS-362-1EFG.

CLASS 1, GROUP D—THE WAY IT USED TO BE . . .

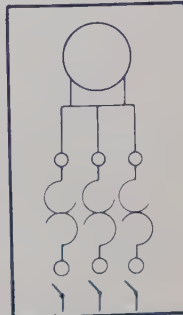


These are some of the complex (and costly!) external components and connections formerly needed in order for a typical oven to meet Class 1, Group D requirements. Even though this is a Blue M Oven—the finest you could buy at the time—what chance would it ever have had to be U.L. Listed?

AND NOW!



- THIS GIVES YOU ALL THIS!**
- These drawings show all the complexity there is to a typical FRICTION-AIRE Oven for Class 1, Group D service. And imagine how this simplicity lowers maintenance costs!
1. No point in oven can exceed indicated air temperature.
 2. Automatic, foolproof interlock between blower and heat source.
 3. Built-in overtemperature protection.
 4. Automatic exhaust.
 5. Mechanical convection.
 6. Motor protection and main switch.





GENERAL SPECIFICATIONS—ALL MODELS

CONTROL SYSTEM

POWER-O-MATIC 90 Non-Electric Proportioning FRICTION-AIRE Control System.

OVERTEMPERATURE PROTECTION—non-electric, built-in.

MEMORY RING® Temperature Calibrating Dial.

DIAL POINTER LOCK

READY-READ TEMPERATURE INDICATOR—3½" diameter, stainless sensing bulb. Dual scale in degrees C. and F.

CONSTRUCTION

HOUSING—all-welded heavy gauge cold-rolled steel, reinforced.

INTERIOR—type 304-2B stainless except Batch Oven which is heavy gauge steel with high temp aluminum paint. All models heli-arc welded to prevent seepage of fumes into insulated walls.

EXTERIOR FINISH—primer coat plus attractive baked-on Formica

white enamel.

SPECIAL INSULATION—5" thick compressed bat-type Fiberglas.

DOOR—double wall with double silicone rubber seals plus stainless spring heat barriers around perimeter for positive seal.

HARDWARE—exclusive adjustable no-slam, cam-action latch and hinges, chrome-plated.

RELIEF PANEL AND SAFETY CAGE—in center of back wall.

SHELVES—two, stainless rod type with non-tilting double-runner supports for shelf adjustment on 2" centers. Batch Oven: shelves optional, of heavy steel angle iron framing and expanded metal. Supported by channels, spaced every 4" (10 positions).

MOTOR STARTER(S)—positive, safe operation. Class 1, Group D.

MOTOR BLOWER SYSTEM(S)—finest quality, designed exclusively for efficient unit operation as described. Class 1, Group D motors and starters with approved M.I. cable and fittings.

OPERATING AND CONTROL CHARACTERISTICS

Chamber Type (Series)	Bench and Floor *U.L. Listed (HS-1002EFG Series)	Bench and Floor (HS-1004-1EFG)	Batch (Model HS-362-1EFG)
RANGE	15°C. above ambient to +150°C. (+302°F.)	15°C. above ambient to +260°C. (+500°F.)	15°C. above ambient to +150°C. (+302°F.)
TYPICAL AIR TEMP UNIFORMITY	At +100°C.: ±0.5°C.	At +100°C.: ±0.5°C. At +200°C.: ±1.0°C.	At +100°C.: ±0.5°C. At +150°C.: ±1.0°C.
TYPICAL MAXIMUM RATE OF RISE (NO LOAD)	To +150°C.: 120 Min.	To +204°C.: 75 Min. To +260°C.: 140 Min.	To +100°C.: 30 Min. To +150°C.: 60 Min.
MAXIMUM COOLING RATE (NO LOAD)	To +50°C.: 30 Min.	To +50°C.: 30 Min.	To +50°C.: 30 Min.
CONTROL ACCURACY	±0.5°C.	±0.5°C.	±0.5°C.
DRIFT (OVER 24-HR. PERIOD)	At + 50°C.: ±1.0°C. At +100°C.: ±0.75°C. At +150°C.: ±0.50°C.	At + 50°C.: ±1.0°C. At +100°C.: ±0.75°C. At +150°C.: ±0.50°C. At +200°C.: ±0.50°C.	At + 50°C.: ±1.0°C. At +100°C.: ±0.75°C. At +150°C.: ±0.50°C.
MAXIMUM SKIN TEMPERATURE	(At +150°C.) Front: +45°C. Sides: +29°C. Door: +32°C. Top: +29°C.	(At +200°C.) Front: +47°C. Sides: +30°C. Door: +34°C. Top: +30°C.	(At +150°C.) Front: +47°C. Sides: +30°C. Door: +34°C. Top: +30°C.
AVERAGE VELOCITY (ADJUSTABLE)	Maximum: 400'/Min. Minimum: 100'/Min.	Maximum: 500'/Min. Minimum: 250'/Min.	Maximum: 500'/Min. Minimum: 200'/Min.

GENERAL SPECIFICATIONS

Model Number	Max. H.P.	Approx. Heating Power (Watts)	Model Number	Max. H.P.	*Approx. Heating Power (Watts)	Inside Dimensions Inches (Cm.)			Overall Dimensions Inches (Cm.)			Cubic Feet Cap.
						W.	D.	H.	W.	D.	H.	
**HS-1002EFG	1.0	500	**HS-1004-1EFG	1.0	600	14 (35)	17 (43)	12 (31)	37 (93)	33 (84)	48 (120)	1.3
HS-1202EFG	2.0	1300	HS-1204-1EFG	3.0	2000	25 (63)	20 (51)	20 (51)	42 (106)	39 (98)	63 (159)	5.2
HS-3802EFG	3.0	2000	HS-3804-1EFG	5.0	3000	38 (95)	25 (63)	25 (63)	57 (144)	44 (111)	68 (172)	13.7
			HS-362-1EFG	10.0	6500	36 (90)	36 (90)	48 (120)	66 (167)	58 (147)	91 (231)	36.0

*Standard voltages, all models: 208V./240V./480V./3Ph./60Hz. A.C. Chambers will operate satisfactorily on 208V./3Ph./60Hz. A.C. when motor is connected for 240V./3Ph./60Hz. A.C. operation.

**Bench model.

All wiring complete and enclosed to meet amended N.E. Code. Approved M.I. cable and fittings used throughout. HS-1004 series optionally available as gravity chambers.

SEND FOR ADDITIONAL INFORMATION AND ALL PRICES

BLUE M EQUIPMENT

A SALES AND SERVICE BRANCH OF

BLUE M EQUIPMENT COMPANY

Corporate Headquarters: Blue Island, Illinois 60406

Arizona, Scottsdale 85251
California, El Monte 91731
California, Sunnyvale 94086
Florida, Orlando 32789
Georgia, Atlanta 30341

Illinois, Blue Island 60406
Massachusetts, Framingham 01701
Michigan, Allen Park 48101
New York, Elmsford 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

APPLICATION: How to be assured of maximum safety while heating a variety of general-purpose workloads of a critical nature at higher temperatures.

OPERATING AND CONTROL CHARACTERISTICS

TEMPERATURE RANGE

15°C. above ambient to +260°C.
(+500°F.)

RUN-UP TIME (no Load)

To maximum temperature:
140 minutes

MAXIMUM COOLING RATE

(No Load) To +50°C.: 30 minutes

CONTROL ACCURACY: $\pm 0.5^\circ\text{C}$.

DRIFT

(Over 24-hr. period)

At +100°C.: $\pm 0.75^\circ\text{C}$.

At +200°C.: $\pm 0.50^\circ\text{C}$.

MAXIMUM SKIN TEMPERATURE

(At +150°C.)

Front: +47°C. Sides: +30°C.

Door: +34°C. Top: +30°C.

AVERAGE VELOCITY

(Adjustable)

Maximum: 500'/minute

Minimum: 250'/minute

SOLUTION:

BLUE M

FRICTION-AIRE TM
PATENTED

CLASS A OVENS

with ~~POWER-O-MATIC 90~~ ^{PATENTED} **non-electric proportioning control system**
 and non-electric overtemperature protection

This series of three models in popular bench or floor configurations puts the unique FRICTION-AIRE principle to work at temperatures to +260°C. (+500°F.). Typical applications for which these chambers are admirably suited include life-testing, particularly with workloads dissipating large amounts of heat, paint baking, aging, drying and general utility work of a critical nature. As the operating and control characteristics at left indicate, these ovens offer performance to fulfill the strictest standards, yet the application of the FRICTION-AIRE elementless system and its many distinct advantages described on pages 72 and 73 affords a degree of safety never before possible in such chambers.

Because of the broad application of Class A Ovens, Blue M has engineered two other series in conventional batch oven configuration. One features Blue M's patented POWER-O-MATIC 60® Saturable Reactor Proportioning Control, the other the exclusive Microtrol Control. They come in eight sizes ranging from 10 to 96 cubic feet, and have ranges to +316°C. (+600°F.). They are described fully on pages 88-91.

GENERAL SPECIFICATIONS

CONTROL SYSTEM

POWER-O-MATIC 90 Non-Electric Proportioning
 FRICTION-AIRE Control System

OVERTEMPERATURE PROTECTION—non-electric,
 built-in.

MEMORY RING® Temperature Calibrating Dial
DIAL POINTER LOCK

READY-READ TEMPERATURE INDICATOR — 3½"
 diameter, stainless sensing bulb. Dual scale in C.
 and F.

CONSTRUCTION

HOUSING—all-welded heavy gauge cold-rolled steel,
 reinforced.

INTERIOR—Type 304-2B stainless. Heli-arc welded to
 prevent fume seepage into insulated walls.

EXTERIOR FINISH—prime coat plus attractive baked-
 on FORMICA white enamel.

SPECIAL INSULATION—5" thick compressed bat-type
 Fiberglas.

DOOR—double wall with double silicone rubber seals
 plus stainless spring heat barriers around perimeter
 for positive seal.

HARDWARE—exclusive adjustable no-slam, cam-
 action latch and hinges, chrome-plated.

RELIEF PANEL AND SAFETY CAGE—built into center
 of back wall.

EQUIPMENT COVERED BY

OUR

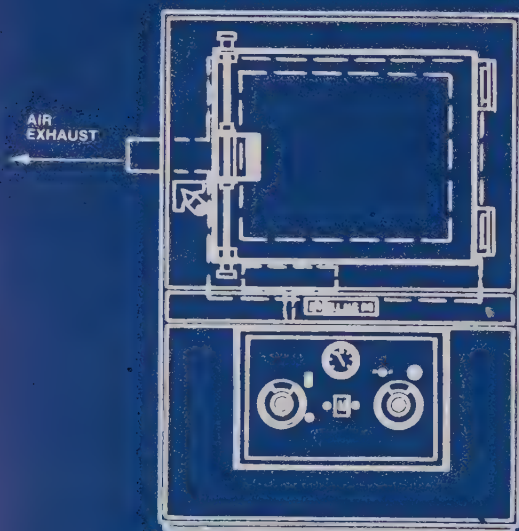
EXCLUSIVE

PARTS
 WARRANTY
 and
 REPLACEMENT
 SERVICE
 PROGRAM



A BLUE M

STANDARD

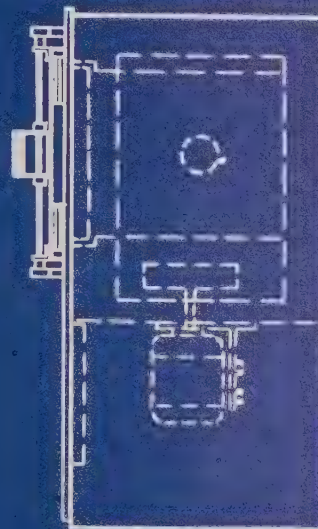


FRONT VIEW

BLUE M
POWER-O-MATIC 90
NON-ELECTRIC
PROPORTIONING
CONTROL SYSTEM
WITH
NON-ELECTRIC
OVERTEMPERATURE
PROTECTION

READY-READ
TEMPERATURE
INDICATOR

RELIEF PANEL
AND
SAFETY CAGE



SIDE VIEW

QUALITY
MOTOR/BLOWER
SYSTEM

GENERAL SPECIFICATIONS

Model Number	Inside Dimensions Inches (Cm.)			Overall Dimensions Inches (Cm.)			*Approx. Heating Power (Watts)	Max. H.P.	Cubic Feet Cap.
	W.	D.	H.	W.	D.	H.			
**POM9-146-1EFG	14 (35)	17 (43)	12 (31)	37 (93)	33 (84)	48 (120)	600	1.0	1.3
POM9-256-1EFG	25 (63)	20 (51)	20 (51)	42 (106)	39 (98)	63 (159)	2000	3.0	5.2
POM9-136-1EFG	38 (95)	25 (63)	25 (63)	57 (144)	44 (111)	68 (172)	3000	5.0	13.7

SHELVES—two, stainless rod type with non-tilting double-runner supports for self adjustment on 2" centers.

MOTOR STARTER—positive, safe operation.

MOTOR BLOWER SYSTEM—finest quality, designed exclusively for efficient operation of FRICTION-AIRE units as described.

OPERATION

Set control for desired temperature. Air inside chamber is put in motion by action of motor/blower system. Temperature rises uniformly throughout work area in accordance with principles of operation described on pages 72 and 73.

*Standard voltages, all models: 208V./240V./480V./3 Ph./60Hz. A.C. Chambers will operate satisfactorily on 208V./3 Ph./60Hz. A.C. when motor is connected for 240V./3 Ph./60Hz. A.C.

**Bench model.

All wiring complete and enclosed to meet amended N.E. Code.

NOTE: All models optionally available as gravity chambers. Write for details.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: SPRING-WOUND MONITORING RECORDERS, CASTERS, SECONDARY OVERTEMPERATURE PROTECTION SYSTEM, AND SHELVES.

SEND FOR ADDITIONAL INFORMATION AND ALL PRICES

BLUE M EQUIPMENT

A SALES AND SERVICE BRANCH OF
BLUE M EQUIPMENT COMPANY
Corporate Headquarters: Blue Island, Illinois 60406

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Michigan, Allen Park 48101
New York, Elmsford 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

**BLUE M**

engineered
products in
ACTION

APPLICATION:

How to match excellent reliability and performance with unequalled safety in a single oven suitable for both volume production runs and extended time /test procedures.

OPERATING AND CONTROL CHARACTERISTICS**TEMPERATURE RANGE**

15°C. above ambient
to +204°C. (+400°F.)

RUN-UP TIME (No Load)

To maximum temperature: 90 minutes

MAXIMUM COOLING RATE

(No Load) To +50°C.: 30 minutes

CONTROL ACCURACY: ±0.5°C.**TYPICAL AIR TEMPERATURE****UNIFORMITY**

At +100°C.: ±0.5°C.

At +200°C.: ±1.0°C.

AVERAGE VELOCITY

(Adjustable)

Maximum: 500'/minute

Minimum: 200'/minute

SOLUTION:**BLUE M**

FRICION-AIRE TM
PATENTED

INDUSTRIAL BATCH OVENS

with **POWER-O-MATIC 90** TM non-electric proportioning control system
and non-electric overtemperature protection

With the application of the remarkable FRICTION-AIRE principle to this new series of Industrial Batch Ovens, Blue M has enabled volume processors to specify chambers that have no peer for performance or safety. Available with capacities of 22.0, 56.0 and 92.0 cubic feet, these ovens are ideal for drying parts and similar work in quantity. Yet the fine performance they offer enables test/processing specialists concerned primarily with close tolerance work to specify them for critical applications. Without question, the utilization of the FRICTION-AIRE heat-without-heater system in these chambers with all the advantages outlined on pages 72 and 73 has ushered in a whole new standard of Batch Oven design.

In addition, these same models are available modified for Class 1, Group D service. They have a temperature range from 15°C. above ambient to +150°C. (+302°F.). Please contact the factory for specifications.

GENERAL SPECIFICATIONS**CONTROL SYSTEM**

POWER-O-MATIC 90 Non-Electric Proportioning
FRICION-AIRE Control System

OVERTEMPERATURE PROTECTION—non-electric,
built-in

MEMORY RING® Temperature Calibrating Dial

DIAL POINTER LOCK

READY-READ TEMPERATURE INDICATOR — 3½"
diameter. Stainless sensing bulb. Dual scale in
°C. and °F.

MOTOR STARTER AND OVERLOAD PROTECTION—
pushbutton, on-off type. Built-in thermal overload
protection insures motor safety.

ELAPSED TIME METER**VOLTMETER****PILOT LIGHT****CONSTRUCTION**

HOUSING—all-welded #14 and #16 gauge cold rolled
steel, reinforced.

WALLS—triple side walls. Inner side walls remov-
able.

INTERIOR FINISH—aluminum paint.

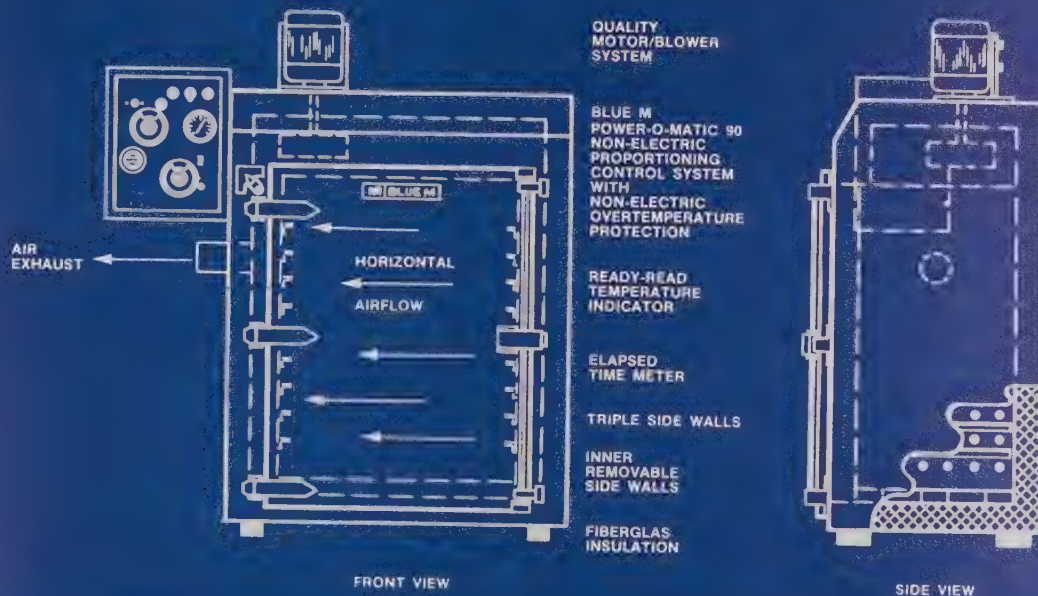
EXTERIOR FINISH—attractive blue enamel.

INSULATION—Fiberglas, all six sides.

**EQUIPMENT COVERED BY
OUR
EXCLUSIVE**

**PARTS
WARRANTY
and
REPLACEMENT
SERVICE
PROGRAM**

**BLUE M**



DOOR(S)—double wall type, insulation and construction same as unit. Exclusively designed rugged hardware. Ovens 36" wide have one door, those 48" wide have two, but no center mullion. Silicone rubber seals.

AIR CIRCULATION—quality ball bearing motor and balanced multi-bladed blower designed especially for FRICTION-AIRE units. Horizontal airflow crosses work chamber from right to left.

SHELF SUPPORTS—angles every 4" for small model, 6" for larger models.

SHELVES (OPTIONAL)—heavy steel angle iron framing and expanded metal or stainless steel.

OPERATION

Set control for desired temperature. Tempered air inside chamber is put in motion horizontally by action of motor/blower system. Temperature rises uniformly throughout work area in accordance with principles of operation described on pages 72 and 73.

GENERAL SPECIFICATIONS

Model Number	Inside Dimensions Inches (Cm.)			Overall Dimensions Inches (Cm.)			*Approx. Heating Power (Watts)	Max. H.P.,	Cubic Feet Cap.
	W.	D.	H.	W.	D.	H.			
FA-242EFG	36 (90)	24 (61)	45 (114)	56 (142)	37 (93)	83 (211)	3500	5.0	22.0
FA-602EFG	36 (90)	48 (120)	57 (144)	81 (205)	61 (154)	98 (249)	5200	7.5	56.0
FA-962EFG	48 (120)	48 (120)	69 (175)	93 (236)	61 (154)	110 (279)	7200	10.0	92.0

*Standard voltages, all models: 208V./240V./480V./3 Ph./60Hz. A.C. Chambers will operate satisfactorily on 208V./3 Ph./60Hz. A.C. when motor is connected for 240V./3 Ph./60Hz. A.C. Please specify exact voltage required for factory wiring and testing. All wiring complete and enclosed to meet amended N.E. Code.

NOTE: All models available for Class 1, Group D. Contact factory for information.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: SHELVES (STEEL OR STAINLESS), FUSED DISCONNECT SWITCHES AND RECORDERS.

SEND FOR ADDITIONAL INFORMATION AND ALL PRICES

BLUE M EQUIPMENT

A SALES AND SERVICE BRANCH OF
BLUE M EQUIPMENT COMPANY
Corporate Headquarters: Blue Island, Illinois 60406

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California, Sunnyvale 94086
Florida, Orlando 32789
Georgia, Atlanta 30341

Illinois, Blue Island 60406
Massachusetts, Framingham 01701
Michigan, Allen Park 48101
New York, Elmsford 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

APPLICATION:

How to be sure that the prolonged time/test procedures now common in industry can be conducted accurately and reliably at lower-than-normal or higher-than-normal temperatures.

OPERATING AND CONTROL CHARACTERISTICS

TEMPERATURE RANGES

To +204°C. (+400°F.)
 To +316°C. (+600°F.)
 To +400°C. (+750°F.)

MINIMUM TEMPERATURE: 5°C.
 above ambient with One-Pass Air-Flow operating.

RUN-UP TIME (No Load)
 To maximum temperature: 90 minutes

CONTROL ACCURACY: $\pm 0.5^{\circ}\text{C}$.

SETABILITY: $\pm 1.0^{\circ}\text{C}$.

REPEATABILITY: $\pm 0.5^{\circ}\text{C}$.

TYPICAL AIR TEMPERATURE UNIFORMITY

At +200°C.: $\pm 2.0^{\circ}\text{C}$.

BLUE M CERTIFICATION

All tests conducted with no load, no exhaust, and stabilized chamber under normal conditions of voltage and ambient. When unusual line voltages, ambients, severe loads and exhaust rates exist, please contact local sales offices or factory for recommendations.

BLUE M GUARANTEE

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operating requirements.

SOLUTION:

BLUE M INDUSTRIAL BATCH OVENS

with ~~POWER-O-MATIC~~ **POWER-O-MATIC-60**® Saturable Reactor Proportioning Control System.

Here is the ideal solution for both testing and production of critical parts and components when temperatures to +400°F., +600°F. or +750°F. are required. Five sizes to fit diverse requirements. Designed for 10 to 20 years life under normal operating conditions, these latest Blue M Mechanical Convection Horizontal Air-Flow Batch Ovens assure that even the most ambitious testing program can be undertaken with complete confidence. Various research and production departments of the electronics, pharmaceutical, food, steel, rubber, plastics and other industries will find these quality units unusually well suited for a variety of extended time/test and production applications including: aging, curing, drying, tempering; coil and armature baking, synthetic finish baking, preheating plastics, curing coated plating racks, core baking, silicone baking and transformer tests. All models are also available with stainless steel interiors and/or exteriors. MAX-SET overtemperature protection, now standard, protects workload and equipment.

GENERAL SPECIFICATIONS

CONTROL SYSTEM

POWER-O-MATIC 60 Saturable Reactor Proportioning Control System

MEMORY RING® Temperature Calibrating Dial

DIAL POINTER LOCK

MAX-SET™ OVERTEMPERATURE PROTECTION

INTERLOCK SWITCH—shuts off power when control panel is opened.

READY-READ TEMPERATURE INDICATOR— $3\frac{1}{2}$ " diameter. Stainless sensing bulb. Dual scale in C. and F.

MOTOR OVERLOAD PROTECTION

ELAPSED TIME METER

VOLTMETER

PILOT LIGHT

CONSTRUCTION

HOUSING—all-welded #14 and #16 gauge cold rolled steel, reinforced.

WALLS—triple side walls. Inner side walls removable.

INTERIOR FINISH—aluminum paint.
 (Stainless optional).

EXTERIOR FINISH—attractive blue enamel.
 (Stainless optional).

INSULATION—Fiberglas.

DOOR(S)—double wall type, insulation and construction same as unit. Smaller units have one door, those 48" wide have two. Industrial hardware. Silicone rubber seal.

ETERNA HEATER BANKS—cylindrical type, assure years of service.

DIRECT DRIVE AIR CIRCULATION—quality ball bearing motor and balanced multi-bladed blower designed especially for these units. No bearings, pulleys or belts.

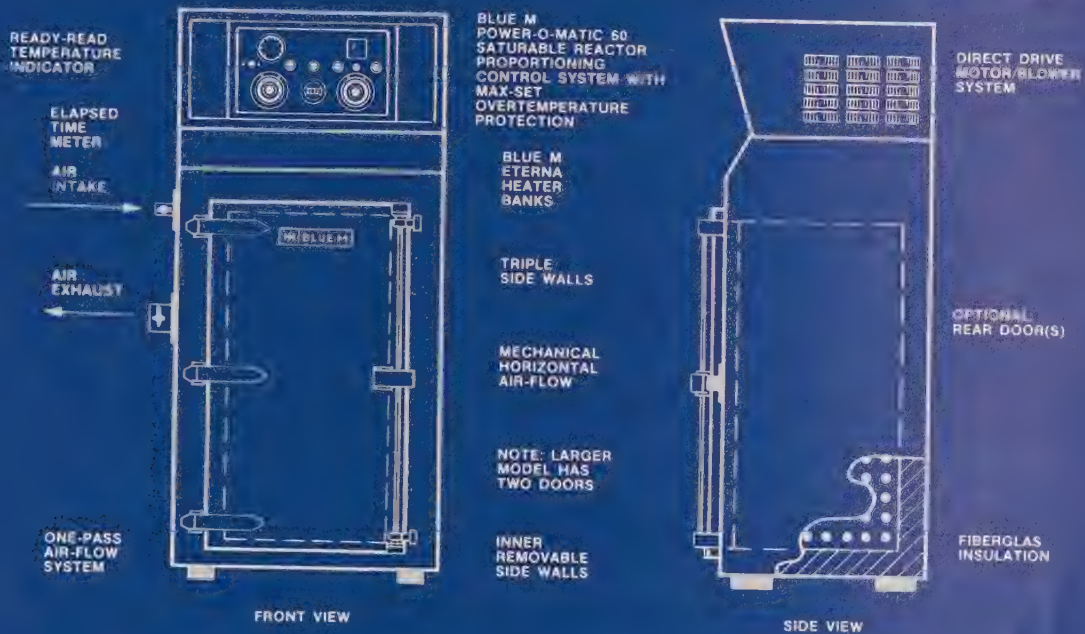
EQUIPMENT COVERED BY

OUR EXCLUSIVE
 PARTS
 WARRANTY
 and
 REPLACEMENT
 SERVICE
 PROGRAM



A BLUE M

STANDARD



SHELF SUPPORTS—angles every 4".

SHELVES (OPTIONAL)—heavy steel angle iron framing and expanded metal. Aluminum paint. Stainless shelves are optional.

ADJUSTABLE ONE-PASS AIR-FLOW SYSTEM—tempered air passes over heaters and through chamber only once if necessary. Permits almost 100% exhaust. Higher K.W. rating may be required for maximum temperature if higher exhaust rate is needed. Side mounted air damper regulator.

OPERATION

Set control for desired temperature. Air, heated by black heat, "controlled" low-watt density shielded ETERNA elements, propelled mechanically and horizontally across working chamber for uniform heat distribution. Air changed approximately 50 times per minute. Air velocity through work space is approximately 250 F.P.M. NO RADIANT HEAT

Model numbers and typical characteristics shown for +316°C. (+600°F.) range only. Units with ranges of +204°C. (+400°F.) and +400°C. (+750°F.) have similar I.D. and O.D. but total KVA increases or decreases according to temperature range. Write for details.

GENERAL SPECIFICATIONS

Model Number	Inside Dimensions Inches (Cm.)			Overall Dimensions Inches (Cm.)			Total KVA	*Voltage 60 Hz. A.C. 3 Phase	Cubic Feet Cap.
	W.	D.	H.	W.	D.	H.			
POM-106F	19 (48)	20 (51)	39 (98)	37 (93)	31 (78)	75 (190)	9.2	240 V	10.0
POM-166F	24 (61)	24 (61)	48 (120)	44 (110)	37 (93)	83 (211)	10.5	240 V.	16.0
POM-246F	36 (90)	24 (61)	48 (120)	56 (142)	37 (93)	83 (211)	12.7	240 V.	24.0
POM-326F	48 (120)	24 (61)	48 (120)	68 (170)	37 (93)	83 (211)	13.7	240 V.	32.0
POM-366F	36 (90)	36 (90)	48 (120)	56 (142)	49 (123)	83 (211)	14.4	240 V	36.0

*Other voltages available all models: 208V. and 480V./3Ph

All wiring complete and enclosed to meet N.E. Code, as amended.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: LEAD-IN PORTS, GLASS OBSERVATION PANELS, PYROMETERS, RECORDERS, SHELVES, TIMERS, FUSED DISCONNECT SWITCHES, AIR-FLOW SWITCH AND CASTERS.

SEND FOR ADDITIONAL INFORMATION AND ALL PRICES

BLUE M EQUIPMENT

A SALES AND SERVICE BRANCH OF
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Corporate Headquarters: Blue Island, Illinois 60406

Arizona, Scottsdale 85251
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Georgia, Atlanta 30341

Illinois, Blue Island 60406
Massachusetts, Framingham 01701
Michigan, Allen Park 48101
New York, Elmsford 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

APPLICATION:

How to achieve ultra-reliability and unmatched accuracy and uniform temperature performance in a single oven suitable for both production runs and extended time/test procedures.

OPERATING AND CONTROL CHARACTERISTICS

TEMPERATURE RANGES

To +204° C. (+400° F.)

To +316° C. (+600° F.)

To +400° C. (+750° F.)

MINIMUM TEMPERATURE:

5° C. above ambient with One-Pass Air-Flow operating.

RUN-UP TIME (No Load)

To maximum temperature: 90 minutes

CONTROL ACCURACY: $\pm 0.5^{\circ}\text{C}$.

SETABILITY: $\pm 1.0^{\circ}\text{C}$.

REPEATABILITY: $\pm 0.5^{\circ}\text{C}$.

TYPICAL AIR TEMPERATURE UNIFORMITY

At +200° C.: $\pm 2.0^{\circ}\text{C}$.

BLUE M CERTIFICATION

All tests conducted with no load, no exhaust and stabilized chamber under normal conditions of voltage and ambient. When unusual line voltages, ambients, severe loads and exhaust rates exist, please contact local sales offices or factory for recommendations.

BLUE M GUARANTEE

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operating requirements.

SOLUTION:

BLUE M INDUSTRIAL BATCH OVENS

with **POWER-O-MATIC 60**® Saturable Reactor Proportioning Control System.

These Blue M Mechanical Convection Horizontal Air-Flow Industrial Batch Ovens provide 60, 80, or 96 cubic feet of production/testing volume with a temperature control accuracy, uniformity and reliability usually reserved only for small research units. This unique characteristic makes them especially valuable for manufacturers of critical electronic parts and components with rigid quality control standards to meet who also have ambitious research/testing programs. These ovens are recommended for aging, curing, drying, tempering, coil and armature baking, preheating plastics, curing coated plating racks, core baking, silicone baking, and transformer tests. These ovens are available with three operating ranges: +400° F., to +600° F. and to +750° F. Also with stainless steel interior and/or exteriors. Overtemperature protection, now standard, safeguards workload and equipment.

Blue M's versatility permits us to supply these units modified to include higher K.W. inputs for unusually heavy loads, roll-in racks and dollies, and even a second door at the rear. The Blue M ETERNA heating elements are located at the top section. They are shielded so there is no radiant heat problem. Provides safety from accidental spillage, etc. Similar ovens equipped with POWER-O-MATIC 60 Programmer-Controller or with a simplified control system for less critical applications are described elsewhere in this section.

GENERAL SPECIFICATIONS

CONTROL SYSTEM

POWER-O-MATIC 60 Saturable Reactor Proportioning Control System.

MEMORY RING® Temperature Calibrating Dial.

DIAL POINTER LOCK

MAX-SET™ OVERTEMPERATURE PROTECTION

READY-READ TEMPERATURE INDICATOR— $3\frac{1}{2}$ " diameter. Stainless sensing bulb. Dual scale in C. and F.

MOTOR OVERLOAD PROTECTION

INTERLOCK SWITCH—shuts off power when control panel is opened.

ELAPSED TIME METER

VOLTMETER

PILOT LIGHT

CONSOLE INSTRUMENT CABINET

CONSTRUCTION

HOUSING—all-welded #14 and #16 gauge cold rolled steel, reinforced.

WALLS—triple side walls. Inner side walls removable.

INTERIOR FINISH—aluminum paint. (Stainless optional).

EXTERIOR FINISH—attractive blue enamel. (Stainless optional).

INSULATION—Fiberglas.

DOOR(S)—double wall type, insulation and construction same as unit. Industrial hardware. Units 36" wide have one door, those 48" wide have two, but no center mullion. Silicone rubber seal.

ETERNA HEATER BANKS—cylindrical type, assure years of service.

DIRECT DRIVE AIR CIRCULATION—quality ball bearing motor and balanced multi-bladed blower designed especially for these units. No bearings, pulleys or belts.

EQUIPMENT COVERED BY
OUR
EXCLUSIVE

PARTS
WARRANTY
and
REPLACEMENT
SERVICE
PROGRAM



A BLUE M

STANDARD



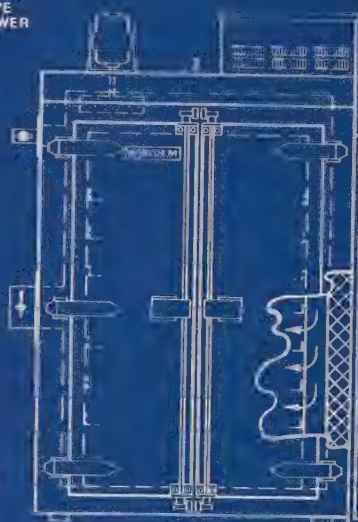
DIRECT DRIVE
MOTOR/BLOWER
SYSTEM

AIR
INTAKE

AIR
EXHAUST

ONE-PASS
AIR-FLOW
SYSTEM

REMOVABLE
INNER
SIDE WALLS



FRONT VIEW

BLUE M
ETERna
Heater
Banks

ELAPSED
TIME
METER

READY-READ
TEMPERATURE
INDICATOR

BLUE M
POWER-O-MATIC 50
SATURABLE REACTOR
PROPORTIONING
CONTROL SYSTEM WITH
MAX-SET
OVERTEMPERATURE
PROTECTION

MECHANICAL
HORIZONTAL
AIR-FLOW

TRIPLE
SIDE WALLS

FIBERGLAS
INSULATION

NOTE: SMALLER
MODEL HAS
ONLY ONE DOOR



SIDE VIEW

OPTIONAL
REAR DOOR(S)

SHELF SUPPORTS—angles every 6".

SHELVES (OPTIONAL)—heavy steel angle iron framing and expanded metal.

ADJUSTABLE ONE-PASS AIR-FLOW—tempered air passes over heaters and through chamber only once if necessary. Permits almost 100% exhaust. Higher K.W. rating may be required for maximum temperature if high exhaust rate is needed. Side mounted air damper regulator.

OPERATION

Set control for desired temperature. Air, heated by black heat, "controlled" low-watt density shielded ETERna elements, propelled mechanically and horizontally across working chamber for uniform heat distribution. Air changed approximately 50 times per minute. Air velocity through work space is approximately 250 F.P.M. NO RADIANT HEAT.

Model numbers and typical characteristics shown for +316°C. (+600°F.) range only. Units with ranges to +204°C. (+400°F.) and +400°C. (+750°F.) have similar I.D. and O.D. but total KVA increases or decreases according to temperature range. Write for details.

GENERAL SPECIFICATIONS

Model Number	Inside Dimensions Inches (Cm.)			Overall Dimensions Inches (Cm.)			Total KVA	Voltage 60 Hz. A.C. 3 Phase	Cubic Feet Cap.
	W.	D.	H.	W.	D.	H.			
POM-606F	36 (90)	48 (120)	60 (152)	81 (205)	61 (154)	93 (236)	22.9	240 V.	60.0
POM-806F	48 (120)	48 (120)	60 (152)	93 (236)	61 (154)	93 (236)	27.9	240 V.	80.0
POM-966F	48 (120)	48 (120)	72 (183)	93 (236)	61 (154)	105 (264)	33.4	240 V.	96.0

*Other voltages available all models: 208V. and 480V./3Ph.

All wiring complete and enclosed to meet N.E. Code, as amended.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: SHELVES (STEEL OR STAINLESS), GLASS OBSERVATION PANELS, ROLL-IN RACKS, DOLLIES, AUTOMATIC PROGRAM TIMERS, LEAD-IN PORTS, FUSED DISCONNECT SWITCHES, REAR ACCESS DOOR, RECORDERS, INDICATING PYROMETERS, SAFETY DOOR SWITCHES, STAINLESS STEEL BLOWERS AND SHAFTS, AIR-FLOW SWITCH, STAINLESS INTERIORS, AND STAINLESS EXTERIORS

SEND FOR ADDITIONAL INFORMATION AND ALL PRICES

BLUE M EQUIPMENT

A SALES AND SERVICE BRANCH OF
BLUE M EQUIPMENT COMPANY
Corporate Headquarters: Blue Island, Illinois 60406

Arizona, Scottsdale 85251
California, El Monte 91731
California, Sunnyvale 94086
Florida, Orlando 32789
Georgia, Atlanta 30341

Illinois, Blue Island 60406
Massachusetts, Framingham 01701
Michigan, Allen Park 48101
New York, Elmstord 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

APPLICATION:

How to achieve ultra-reliable testing and/or production performance for critical applications requiring programming and recording of time and temperature, accurately and uniformly.

OPERATING AND CONTROL CHARACTERISTICS**TEMPERATURE RANGES**

To +204°C. (+400°F.)

To +316°C. (+600°F.)

MINIMUM TEMPERATURE:

5°C. above ambient with One-Pass Air-Flow operating.

RUN-UP TIME (No Load)

To maximum temperature:

90 minutes.

CONTROL ACCURACY: $\pm 0.5^{\circ}\text{C}$.**SETABILITY:** $\pm 1.0^{\circ}\text{C}$.**REPEATABILITY:** $\pm 0.5^{\circ}\text{C}$.**TYPICAL AIR TEMPERATURE UNIFORMITY**

At +200°C.: $\pm 2.0^{\circ}\text{C}$.

BLUE M CERTIFICATION

All tests conducted with no load, no exhaust, and stabilized chamber under normal conditions of voltage and ambient. When unusual line voltages, ambients, severe loads and exhaust rates exist, please contact local sales offices or factory for recommendations.

BLUE M GUARANTEE

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operating requirements.

SOLUTION:**BLUE M INDUSTRIAL BATCH OVENS**

with ~~POWER-O-MATIC~~ **POWER-O-MATIC 60**[®] Saturable Reactor Programmer—Controller and Separate Monitoring Recorder.

Blue M Mechanical Convection, Horizontal Air-Flow Industrial Batch Ovens equipped with the exclusive POWER-O-MATIC 60 Saturable Reactor Programmer-Controller and separate monitoring recorder represent a selection of quality units which fit even the most severe time-temperature test/production demands. Ranging in capacity from 10 to 96 cubic feet, these units fit both modest and ambitious programmed production requirements. Yet the inherent accuracy and reliability of the cam type programmer also makes them all applicable for reasearch/testing programs. Oven temperature at any time during the cycle is dependent only on cam cutting accuracy, and does not fluctuate as is the case with on-off programmers. You are assured of complete reliability test after test, run after run.

MAX-SET overtemperature protection, now standard, safeguards workload and equipment. The versatility of modifications to meet your specific needs and described in our other series in this catalog can be applied as well to this series.

Similar ovens equipped with POWER-O-MATIC 60 Saturable Reactor Control System without programming or with a simplified control system for less critical applications are described elsewhere in this section.

GENERAL SPECIFICATIONS**CONTROL SYSTEM**

POWER-O-MATIC 60 Saturable Reactor Programmer-Controller with separate monitoring recorder.

RECORDER—single pen, temperature range to match oven.

BLANK CAMS (2)

Cams cut to your exact program optionally available.

MAX-SET™ OVERTEMPERATURE PROTECTION

INTERLOCK SWITCH—shuts off power when control panel is opened.

MOTOR OVERLOAD PROTECTION**ELAPSED TIME METER****VOLTMETER****PILOT LIGHTS**

CONSOLE INSTRUMENT CABINET—houses all instrumentation.

CONSTRUCTION

HOUSING—all-welded #14 and #16 gauge cold rolled steel, reinforced.

WALLS—triple side walls. Inner side walls removable.

INTERIOR FINISH—aluminum paint.

(Stainless optional).

EXTERIOR FINISH—attractive blue enamel.

(Stainless optional).

INSULATION—Fiberglas.

DOOR(S)—double wall type, insulation and construction same as unit. Industrial hardware. Smaller units have one door, those 48" wide or larger have two, but no center mullion. Silicone rubber seal.

ETERNA HEATER BANKS—cylindrical type, assure years of service.

DIRECT DRIVE AIR CIRCULATION—quality ball bearing motor and balanced multi-bladed blower designed especially for these units. No bearings, pulleys or belts.

SHELF SUPPORTS—angles every 4" for models to 36 cu. ft.; 6" on large units.

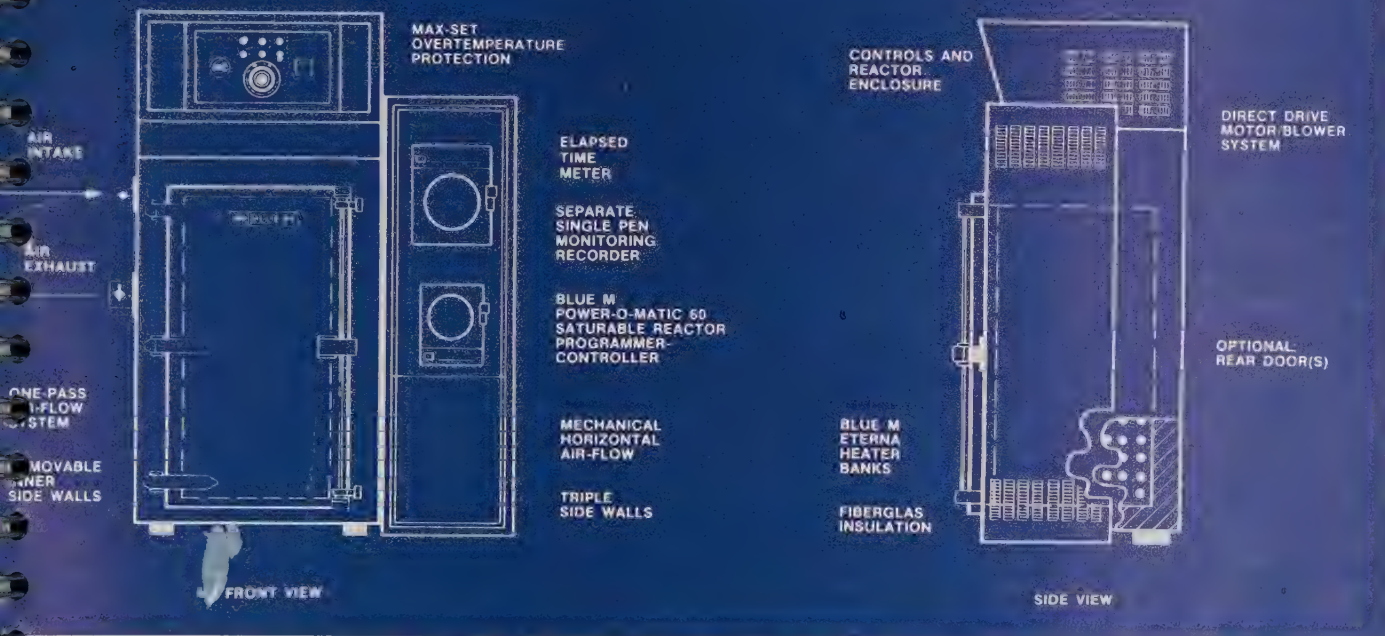
EQUIPMENT COVERED BY
OUR
EXCLUSIVE

PARTS
WARRANTY
and
REPLACEMENT
SERVICE
PROGRAM



A BLUE M

STANDARD



Model numbers and typical characteristics shown for +316°C. (+600°F.) range only. Units with range to +204°C. (+400°F.) have similar I.D. and O.D. but total KVA decreases according to temperature range. Write for details.

SHELVES (OPTIONAL)—heavy steel angle iron framing and expanded metal. Aluminum paint. Also available in stainless.

ADJUSTABLE ONE-PASS AIR-FLOW SYSTEM—tempered air passes over heaters and through chamber only once if necessary. Permits almost 100% exhaust. Higher K.W. rating may be required for maximum temperature if high exhaust rate is needed.

OPERATION

Turn on cam drive. Air, heated by black heat, "controlled" low-watt density shielded ETERNA elements, propelled mechanically and horizontally across working chamber for uniform heat distribution in accordance with program outlined on the cam. Since Blue M's reactor system is non-cycling, accuracy of temperature control is limited only by the accuracy of the cam, and virtually any desired program is possible. Air changed approximately 50 times per minute. Air velocity through work space is approximately 250 F.P.M. NO RADIANT HEAT.

GENERAL SPECIFICATIONS

Model Number	Inside Dimensions Inches (Cm.)			Overall Dimensions Inches (Cm.)			Total KVA	Voltage 60 Hz. A.C. 3 Phase	Cubic Feet Cap.
	W.	D.	H.	W.	D.	H.			
POM-106PCRF	19 (48)	20 (51)	39 (98)	54 (93)	31 (78)	75 (190)	9.2	240V.	10.0
POM-166PCRF	24 (61)	24 (61)	48 (120)	61 (110)	37 (93)	83 (211)	10.5	240V.	16.0
POM-246PCRF	36 (90)	24 (61)	48 (120)	73 (142)	37 (93)	83 (211)	12.7	240V.	24.0
POM-326PCRF	48 (120)	24 (61)	48 (120)	85 (170)	37 (93)	83 (211)	13.7	240V.	32.0
POM-366PCRF	36 (90)	36 (90)	48 (120)	73 (142)	49 (123)	83 (211)	14.4	240V.	36.0
POM-606PCRF	36 (90)	48 (120)	60 (152)	81 (205)	61 (154)	98 (249)	22.9	240V.	60.0
POM-806PCRF	48 (120)	48 (120)	60 (152)	93 (236)	61 (154)	98 (249)	27.9	240V.	80.0
POM-966PCRF	48 (120)	48 (120)	72 (183)	93 (236)	61 (154)	110 (279)	33.4	240V.	96.0

All wiring complete and enclosed to meet N.E. Code, as amended.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: RATE-OF-RISE OTP, SHELVES (STEEL OR STAINLESS), GLASS OBSERVATION PANELS, ROLL-IN RACKS, DOLLIES, AUTOMATIC PROGRAM TIMERS, LEAD-IN PORTS, COOLING COILS, FUSED DISCONNECT SWITCHES, REAR ACCESS DOOR, INDICATING PYROMETERS, SAFETY DOOR SWITCHES, AIR-FLOW SWITCH, STAINLESS STEEL BLOWERS AND SHAFTS, STAINLESS INTERIORS AND STAINLESS EXTERIORS.

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California, El Monte 91731
California, Sunnyvale 94086
Florida, Orlando 32789
Georgia, Atlanta 30341

Illinois, Blue Island 60406
Massachusetts, Framingham 01701
Michigan, Allen Park 48101
New York, Elmsford 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

APPLICATION:

How to conveniently process large quantities of critical parts and components simultaneously in a constant temperature cabinet with unmatched uniformity, accuracy and reliability.

OPERATING AND CONTROL CHARACTERISTICS**TEMPERATURE RANGES**

To +204° C. (+400° F.)

To +316° C. (+600° F.)

To +400° C. (+750° F.)

MINIMUM TEMPERATURE:

5° C. above ambient with One-Pass Air-Flow operating.

RUN-UP TIME (No Load)

To maximum temperature:
90 minutes.

CONTROL ACCURACY: $\pm 0.5^{\circ}\text{C}$.

SETABILITY: $\pm 1.0^{\circ}\text{C}$.

REPEATABILITY: $\pm 0.5^{\circ}\text{C}$.

TYPICAL AIR TEMPERATURE UNIFORMITY

At +200° C.: $\pm 2.0^{\circ}\text{C}$.

BLUE M CERTIFICATION

All tests conducted with no load, no exhaust, and stabilized chamber under normal conditions of voltage and ambient. When unusual line voltages, ambients, severe loads and exhaust rates exist, please contact local sales offices or factory for recommendations.

BLUE M GUARANTEE

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operating requirements.

SOLUTION:**BLUE M INDUSTRIAL PRODUCTION BATCH OVENS**

with  **Saturable Reactor Proportioning Control System and Multi-Tiered Roll-In Racks.**

These Blue M Mechanical Convection, Horizontal Air-Flow Batch Ovens—available in 8 sizes and 3 temperature ranges—have special recessed bottoms to permit the entrance of roll-in racks with multiple shelves. Racks and shelves are constructed to accommodate either heavy or light loads, depending on requirements. Rear doors, available on special order, facilitate the in-line entrance-exit of the racks—an advantage in certain volume production applications. The patented POWER-O-MATIC 60 Saturable Reactor Proportioning Control System meets the most stringent operating and performance demands. Overtemperature protection, now standard, safeguards workload and equipment. This—plus higher K.W. inputs for unusually heavy loads, capacities from 10 to 96 cubic feet, temperature ranges to +400° F., +600° F. and +750° F., and the variety of accessories listed below enables production and research departments to literally custom-engineer the exact oven they need. Similar units with a less sensitive control for more routine applications are described elsewhere in this section.

GENERAL SPECIFICATIONS**CONTROL SYSTEM**

POWER-O-MATIC 60 Saturable Reactor Proportioning Control System

MAX-SET™ OVERTEMPERATURE PROTECTION

INTERLOCK SWITCH—shuts off power when control panel is opened.

MEMORY RING® Temperature Calibrating Dial

DIAL POINTER LOCK

READY-READ TEMPERATURE INDICATOR— $3\frac{1}{2}$ " diameter. Stainless sensing bulb. Dual scale in F. and C. (Not supplied if recorder is installed.)

ELAPSED TIME METER**VOLTMETER****MOTOR OVERLOAD PROTECTION****PILOT LIGHTS**

CONSOLE INSTRUMENT CABINET—houses all instrumentation. On 60, 80 and 96 cu. ft. models only.

CONSTRUCTION

HOUSING—all-welded #14 and #16 gauge cold rolled steel, reinforced.

WALLS—triple side walls. Inner side walls removable.

INTERIOR FINISH—aluminum paint.
(Stainless optional).

EXTERIOR FINISH—attractive blue enamel.
(Stainless optional).

INSULATION—Fiberglas.

DOOR(S)—double wall type, insulated same as unit. Smaller units have one door, those 48" wide or larger have two, but no center mullion. Industrial hardware. Silicone rubber seals. Stainless seals on +750° F. models.

ETERNA HEATER BANKS—cylindrical type, assure years of service.

DIRECT DRIVE AIR CIRCULATION—quality ball bearing motor and balanced multi-bladed blower designed especially for these units. No bearings, pulleys or belts.

ROLL-IN RACK—all-welded heavy structural steel channels and angles. Aluminum paint. (Stainless

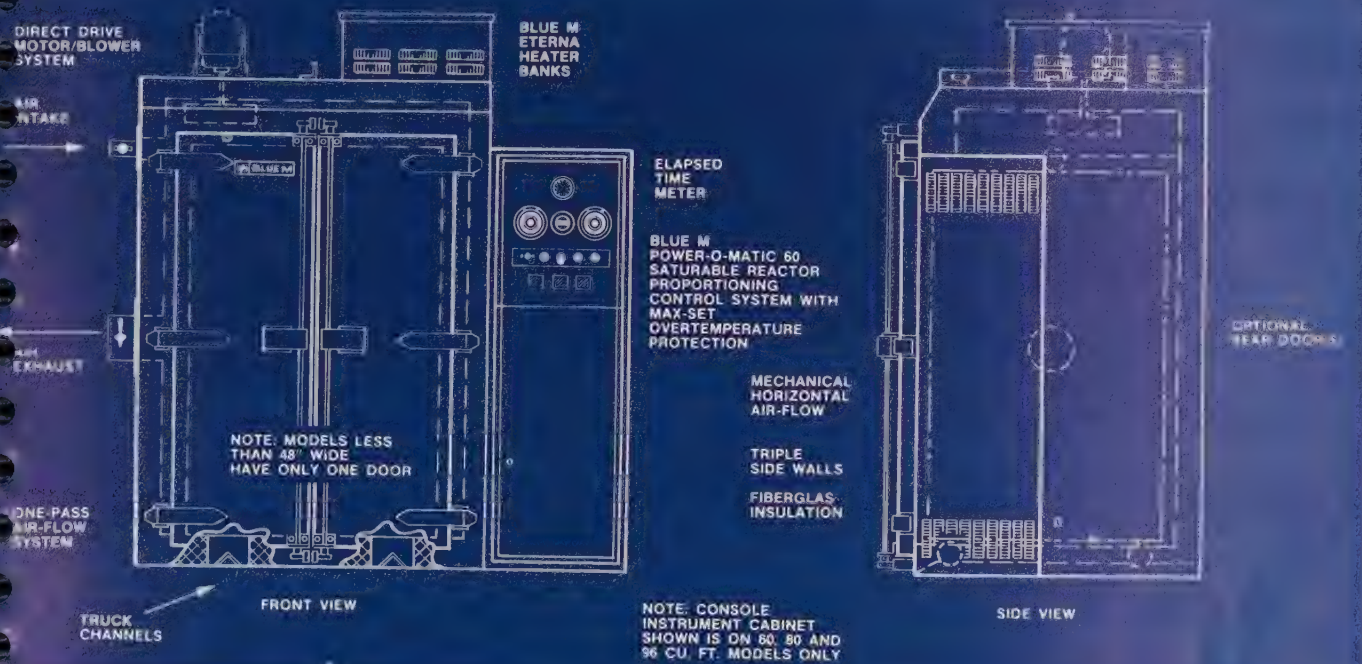
EQUIPMENT COVERED BY OUR EXCLUSIVE

PARTS
WARRANTY
and
REPLACEMENT
SERVICE
PROGRAM



A BLUE M

STANDARD



Model numbers and typical characteristics shown for +316°C. (+600°F.) range only. Units with ranges of +204°C. (+400°F.) and +400°C. (+750°F.) have similar I.D. and O.D. but total KVA increases or decreases according to temperature range. Write for details.

GENERAL SPECIFICATIONS

Model Number	Inside Dimensions Inches (Cm.)			Overall Dimensions Inches (Cm.)			Total KVA	*Voltage 60Hz. A.C. 3 Phase	Cubic Feet Cap.
	W.	D.	H.	W.	D.	H.			
POM-106RIF	19 (48)	20 (51)	39 (98)	37 (93)	31 (78)	71 (180)	9.2	240V.	10.0
POM-166RIF	24 (61)	24 (61)	48 (120)	44 (111)	37 (93)	81 (205)	10.5	240V	16.0
POM-246RIF	36 (90)	24 (61)	48 (120)	56 (142)	37 (93)	81 (205)	12.7	240V	24.0
POM-326RIF	48 (120)	24 (61)	48 (120)	68 (172)	37 (93)	81 (205)	13.7	240V.	32.0
POM-366RIF	36 (90)	36 (90)	48 (120)	56 (142)	49 (123)	81 (205)	14.4	240V	36.0
POM-606RIF	36 (90)	48 (120)	60 (152)	81 (205)	61 (154)	92 (233)	22.9	240V.	60.0
POM-806RIF	48 (120)	48 (120)	60 (152)	93 (236)	61 (154)	92 (233)	27.9	240V	80.0
POM-966RIF	48 (120)	48 (120)	72 (183)	93 (236)	61 (154)	104 (263)	33.4	240V.	96.0

*Other voltage available all models: 208V. and 480V./3Ph.

All wiring complete and enclosed to meet N.E. Code, as amended.

NOTE: Shelf positions: POM-106-8; POM-166, 246, 326-10; POM-606, 806-9; POM-966-11.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: EXTRA ROLL-IN RACKS AND SHELVES (STEEL OR STAINLESS), REAR DOORS, GLASS OBSERVATION PANELS, AUTOMATIC PROGRAM TIMERS, LEAD-IN PORTS, COOLING COILS, RECORDERS, PROGRAMMERS, FUSED DISCONNECT SWITCHES, SAFETY DOOR SWITCHES, AIR-FLOW SWITCH, STAINLESS STEEL BLOWERS AND SHAFTS, STAINLESS INTERIOR, AND STAINLESS EXTERIORS.

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Florida, Orlando 32789
Georgia, Atlanta 30341

Illinois, Blue Island 60406
Massachusetts, Framingham 01701
Michigan, Allen Park 48101
New York, Elmsford 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

OPERATING AND CONTROL CHARACTERISTICS

TEMPERATURE RANGE

To +316°C. (+600°F.)

RUN-UP TIME (No Load)

To maximum temperature: 90 minutes

CONTROL ACCURACY: $\pm 0.5^\circ\text{C}$.

SETABILITY: $\pm 1.0^\circ\text{C}$.

REPEATABILITY: $\pm 0.5^\circ\text{C}$.

TYPICAL AIR TEMPERATURE UNIFORMITY

At +200°C.: $\pm 2.0^\circ\text{C}$.

BLUE M CERTIFICATION

All tests conducted with no load, no exhaust, and stabilized chamber under normal conditions of voltage and ambient. When unusual line voltages, ambients, severe loads and exhaust rates exist, please contact local sales offices or factory for recommendations.

BLUE M GUARANTEE

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operating requirements and the recommendations of NFPA Bulletin 86A—Class A Ovens.

APPLICATION:

How to specify an oven for heating hazardous volatiles which meets the recommendations of NFPA Bulletin 86A.

SOLUTION:

BLUE M CLASS A BATCH OVENS

with ~~POWER-O-MATIC 60~~ ^{POWER-O-MATIC 60} Saturable Reactor Proportioning Control System.

This new series of Blue M ovens has been especially designed to meet the recommendations of NFPA Bulletin 86A covering the heating of hazardous volatiles. This is the oven standard adopted by FIA and FM governing such service. As the specifications on the opposite page indicate, these Blue M Ovens meet this recommended standard.

They assure the ultimate in reliability and performance, too, by featuring the patented POWER-O-MATIC 60 Control. Not only is it inherently safe with no arcing contacts or failure-prone components, but it provides true straight-line, infinitely proportional performance. There isn't a finer control system built. This, coupled with the wide range of unit sizes, various voltages available, and choice of K.W. ratings, clearly tailors these ovens to virtually any facility which must conform to this safety standard.

GENERAL SPECIFICATIONS

(In accordance with recommendations of *NFPA Bulletin 86A—Class A Ovens.)

CONTROL SYSTEM

POWER-O-MATIC 60 Saturable Reactor Proportioning Control System

MEMORY RING® Temperature Calibrating Dial

DIAL POINTER LOCK

OVERTEMPERATURE PROTECTION—FM-approved indicating type, with separate contractor

ELAPSED TIME METER

MAIN SWITCH

VOLTMETERS

PILOT LIGHTS

CONTROL COMPARTMENT—special sheet metal, encloses all controls. Compartment and all terminal housings are grounded. Compartment mounted on top smaller models; 60, 80 and 96 cu. ft. models have console instrument cabinet.

CONSTRUCTION

HOUSING—all-welded heavy gauge cold rolled steel, reinforced. Enamel finish. Suitable guards installed on front surfaces that exceed +160°F.

INTERIOR—heavy gauge steel with high temperature aluminum finish. Seams and ports **welded** vapor

tight. Although welding exceeds requirements and is more costly, Blue M has elected to use this superior construction because of its permanency and its ability to minimize seepage and build-up of potentially dangerous material between chamber walls.

INSULATION—4" Fiberglas on all sides and doors.

DOOR(S)—double wall, insulated and constructed same as unit. Smaller units have one door, those 48" wide have two but no center mullion. Industrial hardware. Silicone rubber seal.

ETERNA HEATER BANKS—cylindrical type, assure years of service.

DIRECT DRIVE MOTOR/BLOWER SYSTEM—quality components throughout. No bearings, pulleys or belts. Blower system is electrically interlocked to prevent heater circuit from energizing unless blower is operating.

ONE-PASS AIR-FLOW SYSTEM—air passes over heaters and through chamber only once if necessary. Permits approximate 100% exhaust of fumes. Side mounted air damper regulator has provision to prevent complete closure. Air-flow switch stops heaters in the event of air-flow loss.

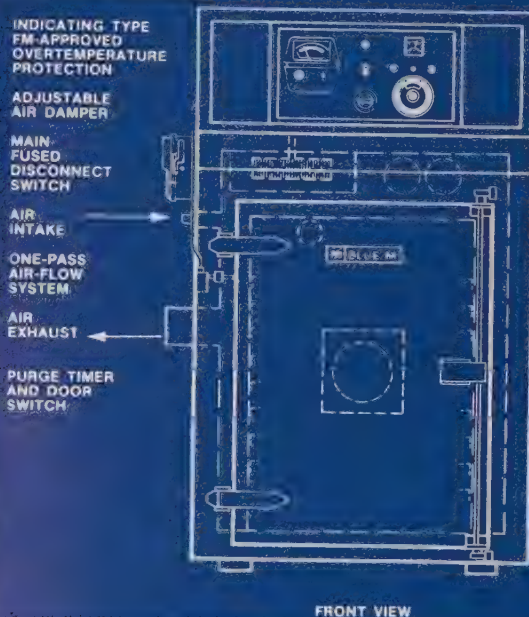
PURGE TIMER/DOOR SWITCH—provide a minimum of four complete air changes before heaters are energized. Timer automatically resets and repurges if power fails or cycle interrupts.

EQUIPMENT COVERED BY
OUR
EXCLUSIVE

PARTS
WARRANTY
and
REPLACEMENT
SERVICE
PROGRAM



BLUE M



FRONT VIEW

BLUE M POWER-O-MATIC 60 SATURABLE REACTOR PROPORTIONING CONTROL SYSTEM

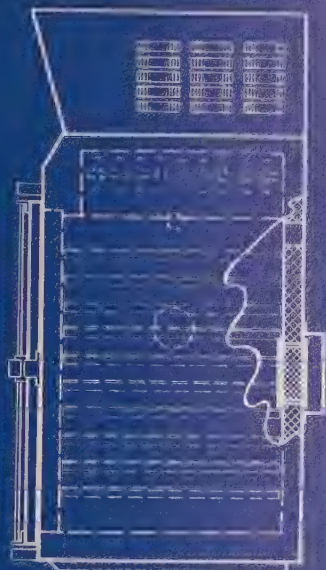
QUALITY DIRECT DRIVE BLOWER SYSTEM

ELAPSED TIME METER

ALL-WELDED INTERIOR

MECHANICAL HORIZONTAL AIR-FLOW

NOTE: Three larger models have controls mounted in console on right side. Units 48" wide have two doors.



SIDE VIEW

*MAXIMUM EXHAUST (CFM)

Model Number	STANDARD K.W.						OPTIONAL K.W.					
	+100°C		+200°C		+300°C		+100°C		+200°C		+300°C	
	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet
POM-106	128	163	52	84	28	55	180	229	76	122	43	84
POM-166	133	169	52	84	27	53	257	326	105	169	66	129
POM-246	162	206	62	100	33	64	252	320	100	161	62	121
POM-326	180	229	71	114	38	74	390	495	162	261	95	185
POM-366	190	241	76	122	43	84	380	483	162	261	95	185
POM-606	304	386	133	214	71	138	570	724	228	367	147	287
POM-806	380	483	162	261	90	175	550	698	223	359	142	277
POM-966	428	544	180	290	104	203	800	1016	366	589	214	417

*All exhaust ratings are based on the following:

1. Stabilized steady-state operation condition, without load.
2. Room ambient temperature of +25°C.
3. Power supply of oven at full voltage rating.
4. Inlet air at standard air conditions.

GENERAL SPECIFICATIONS

Model Number	Inside Dimensions Inches (Cm.)			Overall Dimensions Inches (Cm.)			*Total KVA Standard	Total KVA (Optional)	Cubic Feet Cap.
	W.	D.	H.	W.	D.	H.			
POM-106A-F	19 (48)	20 (51)	39 (98)	37 (93)	37 (93)	74 (185)	9.2	12.2	10
POM-166A-F	24 (61)	24 (61)	48 (120)	44 (110)	43 (108)	82 (208)	10.5	17.5	16
POM-246A-F	36 (90)	24 (61)	48 (120)	56 (142)	43 (108)	82 (208)	12.7	17.7	24
POM-326A-F	48 (120)	24 (61)	48 (120)	68 (170)	43 (108)	82 (208)	13.7	24.7	32
POM-366A-F	36 (90)	36 (90)	48 (120)	56 (142)	55 (139)	82 (208)	14.4	24.7	36
POM-606A-F	36 (90)	48 (120)	60 (152)	81 (205)	67 (172)	93 (236)	22.9	33.7	60
POM-806A-F	48 (120)	48 (120)	60 (152)	93 (236)	67 (172)	93 (236)	27.9	33.7	80
POM-966A-F	48 (120)	48 (120)	72 (183)	93 (236)	67 (172)	105 (264)	33.4	48.7	96

*Standard voltages available, all models: 208V., 240V. and 480V./3Ph./60 Hz. A.C.
OPTIONAL ACCESSORIES AVAILABLE INCLUDE: SHELVES.

SEND FOR ADDITIONAL INFORMATION AND ALL PRICES

BLUE M EQUIPMENT

A SALES AND SERVICE BRANCH OF
BLUE M EQUIPMENT COMPANY
Corporate Headquarters Blue Island, Illinois 60406

Arizona, Scottsdale 85251
California, El Monte 91731
California, Sunnyvale 94086
Florida, Orlando 32789
Georgia, Atlanta 30341

Illinois, Blue Island 60406
Massachusetts, Framingham 01701
Michigan, Allen Park 48101
New York, Elmsford 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

**BLUE M**engineered
products in
ACTION**APPLICATION:**

How to judiciously select an oven for heating hazardous volatiles with a minimum capital outlay while still meeting the recommendations of NFPA Bulletin 86A.

OPERATING AND CONTROL CHARACTERISTICS**TEMPERATURE RANGE**

To +316°C. (+600°F.)

RUN-UP TIME (No Load)

To maximum temperature: 90 minutes

CONTROL ACCURACY: $\pm 1.0^\circ\text{C}$.**SETABILITY:** $\pm 2.0^\circ\text{C}$.**REPEATABILITY:** $\pm 1.0^\circ\text{C}$.**TYPICAL AIR TEMPERATURE UNIFORMITY**

At +200°C.: $\pm 4.0^\circ\text{C}$.

BLUE M CERTIFICATION

All tests conducted with no load, no exhaust, and stabilized chamber under normal conditions of voltage and ambient. When unusual line voltages, ambients, severe loads and exhaust rates exist, please contact local sales offices or factory for recommendations.

BLUE M GUARANTEE

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operation requirements and the recommendations of NFPA Bulletin 86A—Class A Ovens.

SOLUTION:**BLUE M ECONOMY CLASS A BATCH OVENS****with Blue M Microtrol Control**

This new series of Blue M ovens has been developed specifically as a supplement to the widely accepted Class A chambers with the patented POWER-O-MATIC 60® Control described on the previous pages. Utilizing the proven Microtrol Control, these ovens offer all the preengineered design, construction and operating features of the reactor-controlled chambers for a significantly lower capital investment. They are ideal for installations where adherence to the recommendations of NFPA Bulletin 86A is a must, but where peak performance is not a prime consideration.

While economy was a governing factor in the development of these chambers, they should not be regarded as cheap or shoddy in construction. Nor should they be confused with some competitive units which are. In fact, we invite comparison with any comparable equipment on the market. Convince yourself . . . see that when Blue M designs chambers for hazardous applications, we make no compromise with safety or quality.

Blue M also has a series of Class A Ovens utilizing the remarkable FRICTION-AIRE™ principle, the patented electric ovens with no heating elements. These chambers are described on pages 76 and 77.

GENERAL SPECIFICATIONS

(In accordance with recommendations of
*NFPA Bulletin 86A—Class A Ovens.)

CONTROL SYSTEM

BLUE M MICROTROL (Controlling Thermostat) — Sensitive remote bulb type. Uniform on-off differential. Effective ambient temperature compensation built-in. Stainless steel (type 316) capillary tube and sensing bulb with range to suit oven proper. Dials are graduated in degrees Centigrade and Fahrenheit.

MEMORY RING® Temperature Calibrating Dial
DIAL POINTER LOCK

OVERTEMPERATURE PROTECTION—FM-approved indicating type, with separate contactor

MAIN SWITCH**PILOT LIGHTS**

CONTROL COMPARTMENT—Encloses all controls. Compartment and all terminal housings are grounded. Compartment mounted on top smaller models; 60, 80 and 96 cu. ft. models have console instrument cabinet.

CONSTRUCTION

HOUSING—all-welded heavy gauge cold rolled steel, reinforced. Enamel finish. Suitable guards installed on front surfaces that exceed +160°F.

INTERIOR—heavy gauge steel with high temperature aluminum finish. Seams and ports welded vapor tight. Although welding exceeds requirements and is more costly, Blue M has elected to use this superior construction because of its permanency and its ability to minimize seepage and build-up of potentially dangerous material between chamber walls.

INSULATION—4" Fiberglas on all sides and doors.

DOOR(S)—double wall, insulated and constructed same as unit. Smaller units have one door, those 48" wide have two but no center mullion. Industrial hardware. Silicone rubber seal.

ETERNA HEATER BANKS—cylindrical type, assure years of service.

DIRECT DRIVE MOTOR/BLOWER SYSTEM—quality components throughout. No bearings, pulleys, or belts. Blower system is electrically interlocked to prevent heater circuit from energizing unless blower is operating.

ONE-PASS AIR-FLOW SYSTEM—air passes over heaters and through chamber only once if necessary. Permits almost 100% exhaust of fumes. Side mounted air damper regulator has provision to prevent complete closure. Air-flow switch stops heaters in the event of air-flow loss.

PURGE TIMER/DOOR SWITCH—provide a minimum of four complete air changes before heaters are energized. Timer automatically resets and repurges if power fails or cycle interrupts.

EQUIPMENT COVERED BY
OUR
EXCLUSIVE

PARTS
WARRANTY
and
REPLACEMENT
SERVICE
PROGRAM

**BLUE M**

INDICATING TYPE
FM APPROVED
OVERTEMPERATURE
PROTECTION

ADJUSTABLE
AIR DAMPER

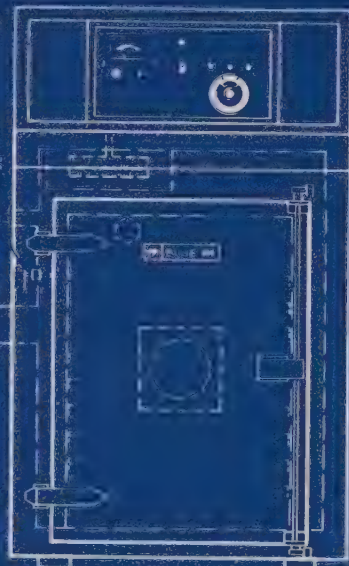
MAIN
FUSED
DISCONNECT
SWITCH

AIR
INTAKE

ONE-PASS
AIR-FLOW
SYSTEM

AIR
EXHAUST

PURGE TIMER
AND DOOR
SWITCH



FRONT VIEW

BLUE M
MICROTRON
(CONTROLLING
THERMOSTAT
SYSTEM)

QUALITY BLOWER
SYSTEM

BLUE M
ETERNA
HEATER
BANK

ALL-WELDED
INTERIOR

FIBERGLAS
INSULATION

MECHANICAL
HORIZONTAL
AIR-FLOW



SIDE VIEW

NOTE: Three larger models
have controls mounted in
console on right side. Units 48"
wide have two doors.

PORT FOR
FIRE
EXTINGUISHING
SYSTEM

BLOW-OUT
RELIEF PANEL
AND
SAFETY CAGE

*MAXIMUM EXHAUST (CFM)

Model Number	+100°C Inlet	+100°C Outlet	+200°C Inlet	+200°C Outlet	+300°C Inlet	+300°C Outlet	Model Number	+100°C Inlet	+100°C Outlet	+200°C Inlet	+200°C Outlet	+300°C Inlet	+300°C Outlet
EM-106	180	229	76	122	43	84	EM-366	380	483	162	261	95	185
EM-166	257	326	105	169	66	129	EM-606	570	724	228	367	147	287
EM-246	252	320	100	161	62	121	EM-806	550	698	223	359	142	277
EM-326	390	495	162	261	95	185	EM-966	800	1016	366	589	214	417

*All exhaust ratings are based on the following:

1. Stabilized steady-state operating condition, without load.
2. Room ambient temperature of +25°C.
3. Power supply of oven at full voltage rating.
4. Inlet air at standard air conditions.

GENERAL SPECIFICATIONS

Model Number	Inside Dimensions Inches (Cm.)			Overall Dimensions Inches (Cm.)			Total KVA	*Voltage 60Hz. A.C. 3 Phase	Cubic Feet Cap.
	W.	D.	H.	W.	D.	H.			
EM-106A-FHP	19 (48)	20 (51)	39 (98)	37 (93)	37 (93)	74 (187)	12.2	240 V	10
EM-166A-FHP	24 (61)	24 (61)	48 (120)	44 (111)	43 (109)	82 (208)	17.5	240 V	16
EM-246A-FHP	36 (90)	24 (61)	48 (120)	56 (142)	43 (109)	82 (208)	17.7	240 V	24
EM-326A-FHP	48 (120)	24 (61)	48 (120)	68 (172)	43 (109)	82 (208)	24.7	240 V	32
EM-366A-FHP	36 (90)	36 (90)	48 (120)	56 (142)	55 (139)	82 (208)	24.7	240 V	36
EM-606A-FHP	36 (90)	48 (120)	60 (152)	81 (205)	67 (170)	93 (236)	33.7	240 V	60
EM-806A-FHP	48 (120)	48 (120)	60 (152)	93 (236)	67 (170)	93 (236)	33.7	240 V	80
EM-966A-FHP	48 (120)	48 (120)	72 (183)	93 (236)	67 (170)	105 (264)	48.7	240 V	96

*Other voltages available, all models: 208 V. and 480 V./3 Ph./60 Hz. A.C.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: SHELVES

BLOW-OUT RELIEF PANEL—with safety cage. Installed through rear wall. Panel area is one sq. ft. per 15 cu. ft. of oven volume.

FIRE EXTINGUISHING PORT—2" dia. through rear wall for customer installation of suitable fire extinguishing system per local jurisdiction.

WIRING—conforms to N.E. Code. All safety control circuits are 120 volts supplied through an instrument transformer with grounded secondary. Fused disconnect switch.

SHELF SUPPORTS—angles every 4" or 6" depending on model.

SHELVES (OPTIONAL)—heavy steel angle iron framing and expanded metal. Aluminum paint.

OPERATION

Set control for desired temperature. Air, heated by black heat, "controlled" low watt density shielded ETERNA elements, propelled mechanically and horizontally across working chamber for uniform heat distribution. Velocity proportioned by manual damper regulation up to maximum exhaust rate shown below for each model. **NO RADIANT HEAT.**

*NFPA Bulletin 86A is the oven standard adopted by FIA (Factory Insurance Agency) and FM (Factory Mutual). All recommended safety features have been followed. Ovens will be approved when customer application data is submitted with Blue M Drawing C-3979Q or C-3980Q to one of the above agencies.

There is no specific section covering Industrial Class A Ovens by OSHA Register other than general requirements of N.E. Code as amended. We believe when and if OSHA does adopt standards they will be in accordance with NFPA Bulletin 86A or similar, and these Blue M units will be suitable.

SEND FOR ADDITIONAL INFORMATION AND ALL PRICES

BLUE M EQUIPMENT

A SALES AND SERVICE BRANCH OF
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Corporate Headquarters: Blue Island, Illinois 60406

Arizona, Scottsdale 85251
California, El Monte 91731
California, Sunnyvale 94086
Florida, Orlando 32789
Georgia, Atlanta 30341

Illinois, Blue Island 60406
Massachusetts, Framingham 01701
Michigan, Allen Park 48101
New York, Elmsford 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

APPLICATION:

How to obtain fast, economical production runs of parts and components where extreme accuracy is not a criteria but where good uniformity and reliability are required.

OPERATING AND CONTROL CHARACTERISTICS

TEMPERATURE RANGES

To +204°C. (+400°F.)

To +316°C. (+600°F.)

To +400°C. (+750°F.)

MINIMUM TEMPERATURE: 5°C.

above ambient with One-Pass Air-Flow operating.

RUN-UP TIME (No Load)

To maximum temperature:
60 minutes.

CONTROL ACCURACY: $\pm 1.0^\circ\text{C}$.

SETABILITY: $\pm 2.0^\circ\text{C}$.

REPEATABILITY: $\pm 1.0^\circ\text{C}$.

TYPICAL AIR TEMPERATURE UNIFORMITY

At +200°C.: $\pm 4.0^\circ\text{C}$.

BLUE M CERTIFICATION

All tests conducted with no load, no exhaust, and stabilized chamber under normal conditions of voltage and ambient. When unusual line voltages, ambients, severe loads and exhaust rates exist, please contact local sales offices or factory for recommendations.

BLUE M GUARANTEE

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operating requirements.

SOLUTION:

BLUE M ECONOMY INDUSTRIAL PRODUCTION BATCH OVENS

with Blue M Microtrol Control and Overtemperature Protection

Blue M Mechanical Convection, Horizontal Air-Flow Economy Industrial Production Batch Ovens—8 sizes, 3 temperature ranges—offer general industry a simple, dependable control design with a rugged, heavily constructed cabinet to combine economy with processing reliability. They fit a wide variety of non-critical applications. They are recommended for general aging, curing, drying, preheating, tempering, coil and armature baking, core baking, synthetic finishes and many similar procedures. These ovens are available with three operating temperature ranges to +400°F., +600°F. and +750°F. and also with stainless steel interiors and/or exteriors. Blue M's versatility permits us to supply these units modified to include higher K.W. inputs for unusually heavy loads, roll-in racks and dollies, and even a second door at the rear. The Blue M ETERNA heating elements are located at the top section. They are shielded so there is no radiant heat problem. Provides safety from accidental spillage, etc.

Batch Ovens with POWER-O-MATIC 60® Saturable Reactor Proportioning Control System and POWER-O-MATIC 60 Programmer-Controller for more critical applications are described elsewhere in this section. It should be noted that these ovens are now equipped with MAX-SET overtemperature protection as standard—an important safeguard for equipment and workload.

GENERAL SPECIFICATIONS

CONTROL SYSTEM

FOR ALL UNITS UP TO +600°F.

BLUE M MICROTROL (Controlling Thermostat)—

Sensitive remote bulb type, Uniform on-off differential. Effective ambient temperature compensation built-in. Stainless steel (type 316) capillary tube and sensing bulb with range to suit oven proper. Dials are graduated in degrees Centigrade and Fahrenheit.

MEMORY RING® Temperature Calibrating Dial DIAL POINTER LOCK

READY-READ TEMPERATURE INDICATOR— $\frac{3}{8}$ " diameter. Stainless sensing bulb. Dual scale in C. and F. Not supplied if recorder is installed.

MERCURY RELAY—silent, fast operating.

MAX-SET™ OVERTEMPERATURE PROTECTION

LINE FUSE

PILOT LIGHT

MOTOR OVERLOAD PROTECTION

CONTROL FOR +750°F. OPERATION ONLY: Indicating and controlling type.

CONSTRUCTION

HOUSING—all-welded #14 and #16 gauge cold rolled steel, reinforced.

WALLS—triple side walls. Inner side walls removable.

INTERIOR FINISH—aluminum paint.

(Stainless optional).

EXTERIOR FINISH—attractive blue enamel.

(Stainless optional).

INSULATION—Fiberglas.

DOOR(S)—double wall type, insulation and construction same as unit. Smaller units have one door, those 48" wide or larger have two, but no center mullion. Industrial hardware. Silicone rubber seals. Stainless seals on +750°F. models.

ETERNA HEATER BANKS—cylindrical type, assure years of service.

DIRECT DRIVE AIR CIRCULATION—quality ball bearing motor and balanced multi-bladed blower designed especially for these units. No bearings, pulleys or belts.

EQUIPMENT COVERED BY

OUR EXCLUSIVE

PARTS WARRANTY and REPLACEMENT SERVICE PROGRAM



A BLUE M

STANDARD



READY-READ
TEMPERATURE
INDICATOR

MAX-SET
OVERTEMPERATURE
PROTECTION

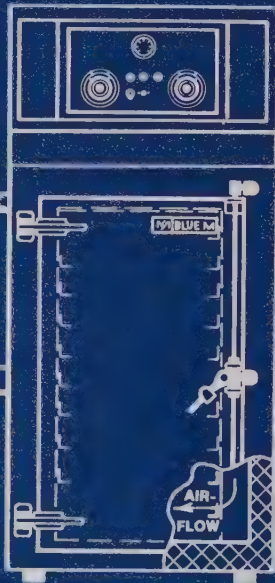
AIR
INTAKE

TRIPLE
SIDE WALLS

AIR
EXHAUST

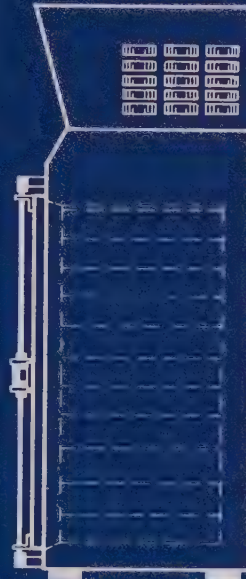
ONE-PASS
AIR-FLOW
SYSTEM

FIBERGLAS
INSULATION



FRONT VIEW

SEE
NOTE
(F)



SIDE VIEW

DIRECT DRIVE
MOTOR/BLOWER
SYSTEM

(A) BLUE M MICROTRON CONTROL PLUS
TEMPERATURE INDICATOR FOR ALL
UNITS UP TO 600°F. RANGE

(B) INDICATING/CONTROLLING TYPE FOR
+750°F. RANGE ONLY (NOT SHOWN)

(C) UNITS OF 10, 16, 24, 36 AND 80
CUBIC FEET HAVE ONE DOOR AS SHOWN

(D) UNITS OF 32, 80 AND 96 CUBIC FEET
(48" WIDE, I.D.) HAVE 2 DOORS

(E) UNITS UP TO 36 CUBIC FEET HAVE
SHELF SUPPORTS ON 4 INCH CENTERS.
ALL OTHER MODELS EVERY 6 INCHES

(F) UNITS OF 80, 90, AND 96 CUBIC FEET
HAVE CONTROL COMPARTMENT AS INDICATED
IN DOTTED LINES

(G) SHIELDED BLUE M ETERNA ELEMENTS
IN TOP SECTION

(H) MECHANICAL HORIZONTAL AIR-FLOW

(I) OPTIONAL: REAR DOOR(S)

SHELF SUPPORTS—angles every 4" for all models
up to 36 cu. ft. Larger models spaced every 6".

SHELVES (OPTIONAL)—heavy steel angle iron fram-
ing and expanded metal. Aluminum paint. Also
available in stainless.

ADJUSTABLE ONE-PASS AIR-FLOW SYSTEM—tem-
pered air passes over heaters and through cham-
ber only once if necessary. Permits almost 100%
exhaust. Higher K.W. rating may be required for
maximum temperature if high exhaust rate is
needed. Side mounted air damper regulator.

OPERATION

Set control for desired temperature. Air, heated by
black heat, "controlled" low-watt density shielded
ETERNA elements, propelled mechanically and hori-
zontally across working chamber for uniform heat
distribution. Air changed approximately 50 times
per minute. Air velocity through work space is ap-
proximately 250 F.P.M. NO RADIANT HEAT.

Model numbers and typical characteristics shown for +316°C. (+600°F.) range
only. Units with ranges of +204°C. (+400°F.) and +400°C. (+750°F.) have similar
I.D. and O.D. but total KVA increases or decreases according to temperature range.
Write for details.

Model Number	Inside Dimensions Inches (Cm.)			Overall Dimensions Inches (Cm.)			Total KVA	Voltage 60 Hz. A.C. 3 Phase	Cubic Feet Cap.
	W.	D.	H.	W.	D.	H.			
EM-106F	19 (48)	20 (51)	39 (98)	37 (93)	31 (78)	75 (190)	8.8	240V.	10.0
EM-166F	24 (61)	24 (61)	48 (120)	44 (111)	37 (93)	83 (211)	9.5	240V.	16.0
EM-246F	36 (90)	24 (61)	48 (120)	56 (142)	37 (93)	83 (211)	11.5	240V.	24.0
EM-326F	48 (120)	24 (61)	48 (120)	68 (172)	37 (93)	83 (211)	12.5	240V.	32.0
EM-366F	36 (90)	36 (90)	48 (120)	56 (142)	49 (123)	83 (211)	13.5	240V.	36.0
EM-606F	36 (90)	48 (120)	60 (152)	80 (203)	61 (154)	93 (236)	19.7	240V.	60.0
EM-806F	48 (120)	48 (120)	60 (152)	92 (233)	61 (154)	93 (236)	23.8	240V.	80.0
EM-966F	48 (120)	48 (120)	72 (183)	92 (233)	61 (154)	105 (264)	26.8	240V.	96.0

Other voltages available, all models: 208 and 480 V./3 Ph.

All wiring complete and enclosed to meet N.E. Code, as amended.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: SHELVES (STEEL OR STAIN-
LESS), GLASS OBSERVATION PANELS, ROLL-IN RACKS, DOLLIES, AUTOMATIC
PROGRAM TIMERS, LEAD-IN PORTS, REAR ACCESS DOOR, RECORDERS,
PROGRAMMERS, SAFETY DOOR SWITCHES, AIR-FLOW SWITCH, STAINLESS
STEEL BLOWERS AND SHAFTS, STAINLESS INTERIORS, AND STAINLESS
EXTERIORS.

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Michigan, Allen Park 48101
New York, Elmsford 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

APPLICATION:

How to efficiently process non-critical parts and components in volume in a constant temperature cabinet with good uniformity, accuracy and reliability.

OPERATING AND CONTROL CHARACTERISTICS

TEMPERATURE RANGES

To +204°C. (+400°F.)
To +316°C. (+600°F.)
To +400°C. (+750°F.)

MINIMUM TEMPERATURE: 5°C.
above ambient with One-Pass Air-Flow
operating.

RUN-UP TIME (No Load)
To maximum temperature:
60 minutes.

CONTROL ACCURACY: $\pm 1.0^{\circ}\text{C}$.

SETABILITY: $\pm 2.0^{\circ}\text{C}$.

REPEATABILITY: $\pm 1.0^{\circ}\text{C}$.

TYPICAL AIR TEMPERATURE UNIFORMITY

At +200°C.: $\pm 4.0^{\circ}\text{C}$.

BLUE M CERTIFICATION

All tests conducted with no load, no exhaust, and stabilized chamber under normal conditions of voltage and ambient. When unusual line voltages, ambients, severe loads and exhaust rates exist, please contact local sales offices or factory for recommendations.

BLUE M GUARANTEE

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operating requirements.

SOLUTION:

BLUE M INDUSTRIAL MULTI-TIERED ROLL-IN-RACK PRODUCTION BATCH OVENS

with Blue M Microtrol Control and Overtemperature Protection

Maximum convenience and operational efficiency in a series of mechanical convection, horizontal air-flow batch ovens offering good, reliable performance characteristics. Available in 8 sizes (from 10 to 96 cubic feet) and 3 temperature ranges (+400°F., +600°F. and +750°F.), they have special recessed bottoms to permit the entrance of roll-in racks with multiple shelves. Depending on requirements, racks and shelves are built to handle either heavy or light loads. To facilitate the in-line entrance-exit of the racks, rear doors—available on special order—are advantageous in certain quantity production work.

These ovens are equipped with the exclusive Blue M Microtrol, a simple, dependable bulb type thermostatic control. It assures accuracy and dependability to meet a variety of non-critical applications. The various sizes and temperature ranges available on these units—plus the many accessories with which they can be equipped—enable the exact unit for any given job to be custom-engineered with less capital investment. Similar units for more exacting requirements are described on earlier pages.

It should be noted that these ovens are now equipped with MAX-SET overtemperature protection as standard—an important safeguard for equipment and workload. Typical large model is illustrated. Smaller models are similar to illustration on preceding pages.

GENERAL SPECIFICATIONS

CONTROL SYSTEM

BLUE M MICROTROL (Controlling Thermostat) — Sensitive remote bulb type. Uniform on-off differential. Effective ambient temperature compensation built-in. Stainless steel (type 316) capillary tube and sensing bulb. Dials are graduated in degrees Centigrade and Fahrenheit.

MEMORY RING® Temperature Calibrating Dial
DIAL POINTER LOCK

READY-READ TEMPERATURE INDICATOR — $3\frac{1}{2}$ " diameter. Stainless sensing bulb. Dual scale in C. and F. (Not supplied if recorder is installed.)

MAX-SET™ OVERTEMPERATURE PROTECTION
MERCURY RELAY—silent, fast operating.

VOLTMETER
PILOT LIGHT
LINE FUSE

CONSTRUCTION

HOUSING—all-welded #14 and #16 gauge cold rolled steel, reinforced.

WALLS—triple side walls. Inner side walls removable.

INTERIOR FINISH—aluminum paint.
(Stainless optional.)

EXTERIOR FINISH—attractive blue enamel.
(Stainless optional.)

INSULATION—Fiberglas.

DOOR(S)—double wall type, insulated same as unit. Smaller units have one door, those 48" wide or larger have two, but no center mullion. Industrial hardware. Silicone rubber seals. Stainless seals on +750°F. models.

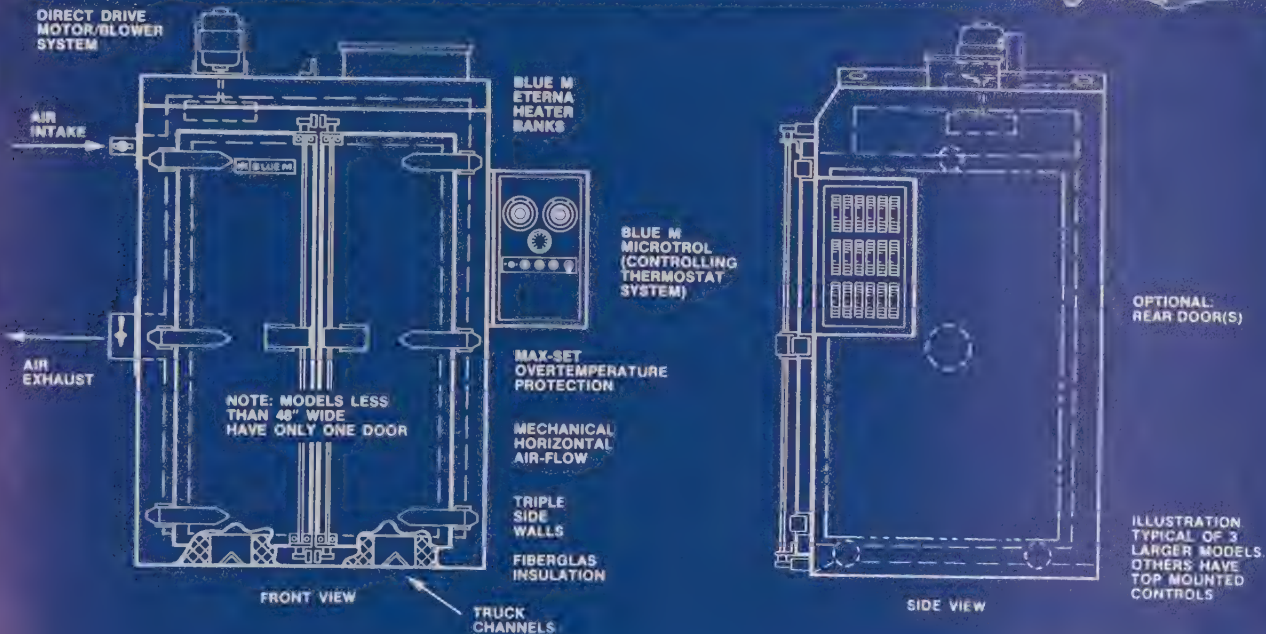
ETERNA HEATER BANKS—cylindrical type, assure years of service.

DIRECT DRIVE AIR CIRCULATION—quality ball bearing motor and balanced multi-bladed blower designed especially for these units. No bearings, pulleys or belts.



A BLUE M

STANDARD



ROLL-IN RACK—all-welded heavy structural steel channels and angles. Aluminum paint. (Stainless optional.) Two rigid and two swivel casters. Shelf angles spaced on 4" centers. For example, in 96 cu. ft. model (48" W. x 48" D. x 72" H. I.D.), racks to hold 16 shelves, 5,000 lbs. gross weight are available on special order. Other racks and shelving proportional to your specific workload.

SHELVES—(OPTIONAL) heavy gauge expanded steel and angle iron frame to support your workload properly. Aluminum paint. (Stainless optional.)

ADJUSTABLE ONE-PASS AIR-FLOW SYSTEM—tempered air passes over heaters and through chamber only once if necessary. Permits almost 100% exhaust. Higher K.W. rating may be required for maximum temperature if high exhaust rate is needed.

OPERATION

Set control for desired temperature. Air, heated by black heat, "controlled" low-watt density shielded ETERNA elements, propelled mechanically and horizontally across working chamber for uniform heat distribution. Air changed approximately 50 times per minute. Air velocity through work space is approximately 250 F.P.M. NO RADIANT HEAT.

Model numbers and typical characteristics shown for +316°C. (+600°F.) range only. Units with ranges of +204°C. (+400°F.) and +400°C. (+750°F.) have similar I.D. and O.D. but total KVA increases or decreases according to temperature range. Write for details.

Model Number	Inside Dimensions Inches (Cm.)			Overall Dimensions Inches (Cm.)			Total KVA	Voltage 60 Hz. A.C. 3 Phase	Cubic Feet Cap.
	W.	D.	H.	W.	D.	H.			
EM-106RIF	19 (48)	20 (51)	39 (98)	37 (93)	31 (78)	70 (177)	8.8	240V.	10.0
EM-166RIF	24 (61)	24 (61)	48 (120)	44 (111)	37 (93)	81 (205)	9.5	240 V	16.0
EM-246RIF	36 (90)	24 (61)	48 (120)	56 (142)	37 (93)	81 (205)	11.5	240V.	24.0
EM-326RIF	48 (120)	24 (61)	48 (120)	68 (172)	37 (93)	81 (205)	12.5	240V	32.0
EM-366RIF	36 (90)	36 (90)	48 (120)	56 (142)	49 (123)	81 (205)	13.5	240V.	36.0
EM-606RIF	36 (90)	48 (120)	60 (152)	80 (203)	61 (154)	92 (233)	19.7	240V	60.0
EM-806RIF	48 (120)	48 (120)	60 (152)	92 (233)	61 (154)	92 (233)	23.8	240V	80.0
EM-966RIF	48 (120)	48 (120)	72 (183)	92 (233)	61 (154)	104 (263)	26.8	240V.	96.0

Other voltages available, all models: 208 and 480 V./3 Ph.

All wiring complete and enclosed to meet N.E. Code, as amended.

NOTE: Shelf positions: EM-106-8; EM-166, 246, 326-10; EM-606, 806-9; EM-966-11.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: EXTRA ROLL-IN RACKS AND SHELVES (STEEL OR STAINLESS), REAR DOORS, GLASS OBSERVATION PANELS, AUTOMATIC PROGRAM TIMERS, LEAD-IN PORTS, RECORDERS, PROGRAMMERS, SAFETY DOOR SWITCHES, AIR-FLOW SWITCH, STAINLESS STEEL BLOWERS AND SHAFTS, STAINLESS INTERIORS, AND STAINLESS EXTERIORS.

SEND FOR ADDITIONAL INFORMATION AND ALL PRICES

BLUE M EQUIPMENT

A SALES AND SERVICE BRANCH OF
BLUE M EQUIPMENT COMPANY
Corporate Headquarters, Blue Island, Illinois 60406

Arizona, Scottsdale 85251
California, El Monte 91731
California, Sunnyvale 94086
Florida, Orlando 32789
Georgia, Atlanta 30341

Illinois, Blue Island 60406
Massachusetts, Framingham 01701
Michigan, Allen Park 48101
New York, Elmsford 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

OVENS

**BLUE M**engineered
products in**ACTION****APPLICATION:**

How to effectively life-test or process extra quantities of critical electronic products and related components in a larger-than average cabinet and still maintain uniform accurate temperatures with safety and reliability.

OPERATING AND CONTROL CHARACTERISTICS**TEMPERATURE RANGES**

15°C. above ambient to +180°C.
(+356°F.)

15°C. above ambient to +260°C.
(+500°F.)

RUN-UP TIME (No Load)

To +180°C.: 60 minutes.

To +260°C.: 60 minutes.

RECOVERY TIME (No Load)

At +125°C., door open 1 minute:
8 minutes.

CONTROL ACCURACY: $\pm 0.5^{\circ}\text{C}$.

SETABILITY: $\pm 1.0^{\circ}\text{C}$.

REPEATABILITY: $\pm 0.5^{\circ}\text{C}$.

TYPICAL AIR TEMPERATURE UNIFORMITY

At +100°C.: $\pm 1.0^{\circ}\text{C}$.

BLUE M CERTIFICATION

All tests conducted with no load, no exhaust, and stabilized chamber under normal conditions of voltage and ambient. When unusual line voltages, ambients, severe loads and exhaust rates exist, please contact local sales offices or factory for recommendations.

BLUE M GUARANTEE

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operating requirements.

SOLUTION:**BLUE M BATCH OVENS (BENCH TYPE)
8 CUBIC FEET**

with **POWER-O-MATIC 60**® Saturable Reactor Proportioning Control System.

These Blue M Mechanical Convection, Horizontal Air-Flow Batch Ovens provide greater uniform and accurate working volume at lower cost without sacrificing reliability. To the volume processor, handling larger and proportionately more valuable workloads, ultra-reliability is an absolute must. But equally important, larger cabinets enable processing to be speeded up with corresponding reduction in per-piece processing cost.

Keys to this reliability and economy in these Blue M units are special care in design and the unique POWER-O-MATIC 60 Control System. Also, the black heat "controlled" low-watt density elements are located in the top section of these units for greater safety. MAX-SET time-day overtemperature protection is now standard.

For special applications, the rear of the oven may be provided with an extra door to enable entrance from either front or rear.

Blue M recommends these units for applications involving electronic components processing aging, curing, etc. Complete thermocouple survey on request.

GENERAL SPECIFICATIONS**CONTROL SYSTEM**

POWER-O-MATIC 60 Saturable Reactor Proportioning Control System.

MAX-SET™ OVERTEMPERATURE PROTECTION

MEMORY RING® Temperature Calibrating Dial.

DIAL POINTER LOCK

ELAPSED TIME METER

VOLTMETER

MAIN SWITCH

PILOT LIGHTS

CONSTRUCTION

HOUSING—all-welded heavy gauge cold rolled steel, reinforced.

WALLS—triple side walls.

INTERIOR FINISH—aluminum paint.

EXTERIOR FINISH—attractive blue enamel.

INSULATION—Fiberglas.

DOOR—double wall type, insulation and construction same as unit. Chrome-plated hardware.

ETERNA HEATER BANKS—cylindrical type, assure years of service.

AIR CIRCULATION—quality ball bearing motor and balanced multi-bladed blower designed especially for these units. Direct drive assembly.

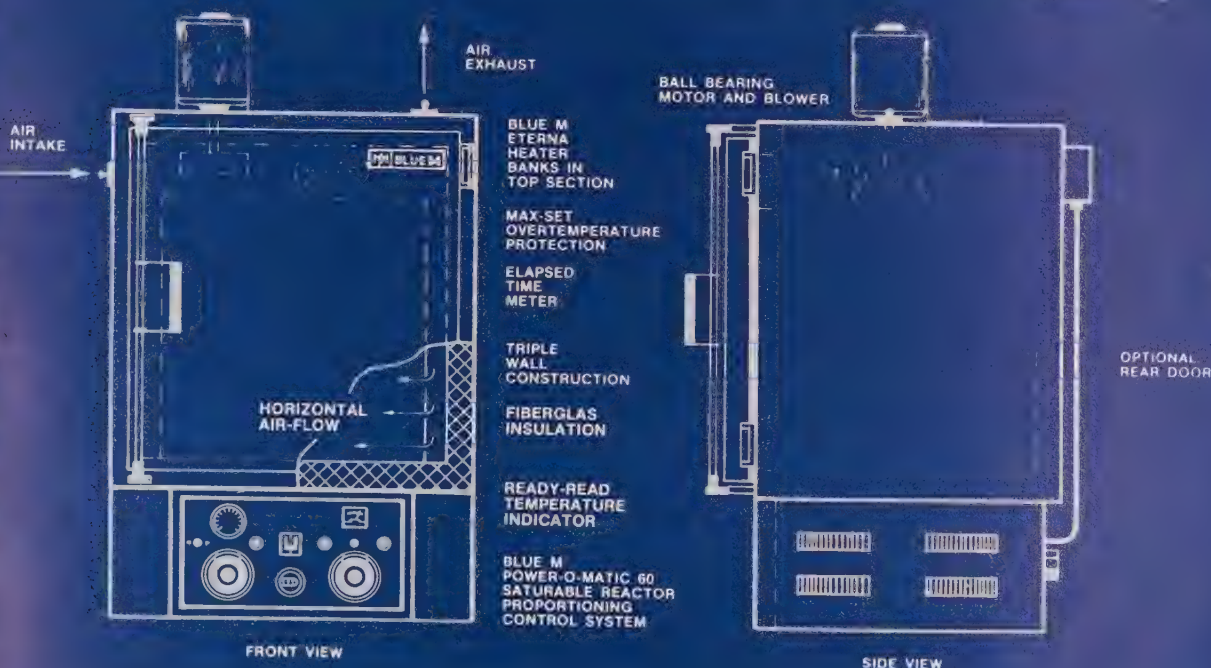
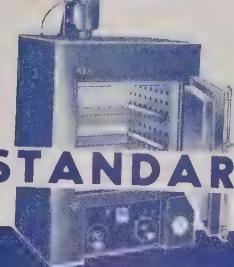
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SERVICE
PROGRAM

**BLUE M**

A BLUE M

STANDARD



SHELF—one, nickel-plated steel, adjustable to ten positions. Extra shelves available.

READY-READ TEMPERATURE INDICATOR—3½" diameter Stainless sensing bulb. Dual scale in C. and F.

AIR INTAKE—adjustable

AIR EXHAUST—adjustable.

OPERATION

Set control for desired temperature. Air, heated by black heat, "controlled" low-watt density shielded ETERNA elements, propelled mechanically and horizontally across working chamber for uniform heat distribution. Air changed approximately 50 times per minute. Velocity through work chamber is approximately 250 F.P.M. Elements located in top section for safety from spillage. NO RADIANT HEAT

TEMPERATURE RANGE: TO +180°C. (+356°F.)

Model Number	Inside Dimensions Inches (Cm.)			Overall Dimensions Inches (Cm.)			Total KVA	Voltage 60 Hz. A.C.
	W.	D.	H.	W.	D.	H.		
POM-5863A-1	24	25	24	37	34	56	2.7	120V./1Ph
POM-5863B-1	(61)	(63)	(61)	(93)	(86)	(142)		208V./1Ph
POM-5863C-1								240V./1Ph

TEMPERATURE RANGE: TO +260°C. (+500°F.)

POM-5886B-1							5.1	208V./1Ph
POM-5886C-1	24	25	24	37	34	56		240V./1Ph
POM-5886F-1	(61)	(63)	(61)	(93)	(86)	(142)		240V./3Ph
POM-5886G-1								480V./3Ph

All wiring complete and enclosed to meet N.E. Code, as amended

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: AUTOMATIC TIMERS, GLASS OBSERVATION PANELS, LEAD-IN PORTS, FLOOR STANDS, EXTRA REAR DOORS, SHELVES, RECORDING AND INDICATING THERMOMETERS

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Massachusetts, Framingham 01701
Michigan, Allen Park 48101
New York, Elmsford 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

**BLUE M**engineered
products in**ACTION****OPERATING AND CONTROL
CHARACTERISTICS****TEMPERATURE RANGE**
45°C. to +260°C. (+500°F.)**RUN-UP TIME** (No Load)
To maximum temperature:
55 minutes.**CONTROL ACCURACY:** $\pm 0.4^\circ\text{C}$.**SETABILITY** (mid-range): $\pm 2.0^\circ\text{C}$.**REPEATABILITY** (mid-range): $\pm 0.5^\circ\text{C}$.**TYPICAL AIR TEMPERATURE
UNIFORMITY**At $+100^\circ\text{C}$.: $\pm 1.0^\circ\text{C}$.
At $+200^\circ\text{C}$.: $\pm 3.0^\circ\text{C}$.**BLUE M CERTIFICATION**

All tests conducted with no load, no exhaust, and stabilized chamber under normal conditions of voltage and ambient. When unusual line voltages, ambients, severe loads and exhaust rates exist, please contact local sales offices or factory for recommendations.

BLUE M GUARANTEE

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operating requirements.

APPLICATION:

How to successfully meet the demands for precision test/processing through a programmed sequence of temperatures with unusually fine repeatability.

SOLUTION:**BLUE M STABIL-THERM® BATCH OVENS
(BENCH TYPE)—8 CUBIC FEET**with ~~POWER-O-MATIC-70~~ ^{PATENTED} **Multi-Step Programmer-Controller.**

The development of a new setpoint programming system for the patented POWER-O-MATIC 70 Solid-State Proportioning Control described on pages 22 and 23 and its application to this series of proven ovens enables Blue M to offer an excellent means to sequentially duplicate various temperatures with $\pm \frac{1}{2}^\circ\text{C}$. repeatability or better. There are no cams to cut; no linkages or mechanical interference. Program sequences are easily changed.

The programmer has six separate setpoint potentiometric dials. The operator simply sets all six, or two, etc. for the desired temperature. The system is activated, and each of the temperatures selected is automatically achieved at the natural maximum rate of the chamber in sequence. Pilot lights continuously indicate that portion of the program in operation.

Positions two through six are equipped with skip switches. When any of these are activated, the sequence will automatically advance to the next position. This feature enables certain temperature sequences to be set up permanently and used at will without disturbing the setting potentiometers.

Please note that at any time a programmed sequence of temperatures isn't necessary, these ovens can be utilized for steady-state test/processing over extended periods. A convenient switch disengages the programmer, and allows the oven to be operated manually in the conventional manner.

Similar units for critical steady-state performance equipped with the patented POWER-O-MATIC 60® Control are described on the preceding page, and others with a standard POWER-O-MATIC 70 Control are described on the next page.

GENERAL SPECIFICATIONS**CONTROL SYSTEM**

POWER-O-MATIC 70 Multi-Step Programmer-Controller with auxiliary manual control for steady-state operation.

TIMER (10 hour) Setting must be common to all setpoints.

MEMORY RING® Temperature Calibrating Dial for precision adjustment of manual control.

DIAL POINTER LOCK

MAX-SET™ OVERTEMPERATURE PROTECTION

READY-READ TEMPERATURE INDICATOR

VOLTMETER

MAIN SWITCH

PILOT LIGHTS

CONSTRUCTION

HOUSING—all-welded heavy gauge cold rolled steel reinforced.

WALLS—triple side walls.

INTERIOR FINISH—aluminum paint.

EXTERIOR FINISH—attractive blue enamel.

INSULATION—Fiberglas.

DOOR—double wall type, insulation and construction same as unit. Silicone rubber seal.

HARDWARE—exclusive adjustable no-slam, cam action latch and chrome-plated hinges.

ETERNA HEATER BANKS—cylindrical type, assure years of service.

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PROGRAM

**BLUE M**



AIR EXHAUST—adjustable.

Set programmer for desired temperature sequence. Air, heated by black heat, "controlled" low-watt density shielded ETERNA elements, propelled mechanically and horizontally for uniform heat distribution. Air changed approximately 50 times per minute. Air velocity through work space is approximately 250 F.P.M. Elements located in top section for safety from spillage. NO RADIANT HEAT.

Model Number	Inside Dimensions Inches (Cm.)			Overall Dimensions Inches (Cm.)			Total KVA	Voltage 60 Hz. A.C. 1 Phase
	W.	D.	H.	W.	D.	H.		
POM-588C-3MSP	24 (61)	25 (63)	24 (61)	37 (93)	34 (86)	56 (142)	3 4 4 4	208/240V

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: SHELVES AND BRACKETS, LEAD-IN PORTS, GLASS OBSERVATION PANELS, FLOOR STANDS, REAR ENTRANCE DOOR, RECORDING, AND INDICATING THERMOMETERS

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

**BLUE M**

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OPERATING AND CONTROL CHARACTERISTICS

TEMPERATURE RANGES

15°C. above ambient to +180°C.
(+356°F.)

15°C. above ambient to +260°C.
(+500°F.)

RUN-UP TIME (No Load)

To maximum temperature:
55 minutes.

CONTROL ACCURACY: $\pm 0.4^{\circ}\text{C}$.

SETABILITY (mid-range): $\pm 1.0^{\circ}\text{C}$.

REPEATABILITY (mid-range): $\pm 0.5^{\circ}\text{C}$.

TYPICAL AIR TEMPERATURE UNIFORMITY

At +100°C.: $\pm 1.0^{\circ}\text{C}$.

At +200°C.: $\pm 3.0^{\circ}\text{C}$.

BLUE M CERTIFICATION

All tests conducted with no load, no exhaust, and stabilized chamber under normal conditions of voltage and ambient. When unusual line voltages, ambients, severe loads and exhaust rates exist, please contact local sales offices or factory for recommendations.

BLUE M GUARANTEE

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operating requirements.

APPLICATION:

How to test and handle production of extra quantities of small parts and components in a larger-than-average cabinet with a low initial investment.

SOLUTION:

BLUE M STABIL-THERM® BATCH OVENS (BENCH TYPE)—8 CUBIC FEET

with ~~POWER-O-MATIC 70~~ ^{PATENTED} **POWER-O-MATIC 70®** Solid-State Proportioning Control System and Built-in Overtemperature Protection

The application of Blue M's exclusive POWER-O-MATIC 70 Solid-State Proportioning Control (described in detail on pages 22 and 23) to these proven batch ovens provides the volume processor of small parts with a dependable chamber at a modest price. The excellent performance characteristics of these units coupled with their superior construction features make them ideal for electronic component processing, plastic heat treating, paint drying and baking, aging, curing, annealing and many other processes and tests in the electronic, paint, steel, rubber, aircraft, chemical and related industries. Built-in overtemperature protection safeguards workloads and equipment.

For extremely critical applications requiring ultra-reliability, we recommend similar units equipped with the POWER-O-MATIC 60® Control described on earlier pages.

GENERAL SPECIFICATIONS

CONTROL SYSTEM

POWER-O-MATIC 70 Solid-State Proportioning Control system

MAX-SET™ OVERTEMPERATURE PROTECTION

MEMORY RING® Temperature Calibrating Dial

DIAL POINTER LOCK

MAIN SWITCH

PILOT LIGHTS

CONSTRUCTION

HOUSING—all-welded heavy gauge cold rolled steel, reinforced

WALLS—triple side walls.

INTERIOR FINISH—aluminum paint.

EXTERIOR FINISH—attractive blue enamel.

INSULATION—Fiberglas.

DOOR—double wall type, insulation and construction same as unit. Silicone rubber seal.

HARDWARE—exclusive adjustable no-slam, cam action latch and chrome-plated hinges.

ETERNA HEATER BANKS—cylindrical type, assure years of service.

AIR CIRCULATION—quality ball bearing motor and balanced multi-bladed blower designed especially for these units.

SHELF—one, wire rod type, nickel-plated steel, adjustable to ten positions. Extra shelves available.

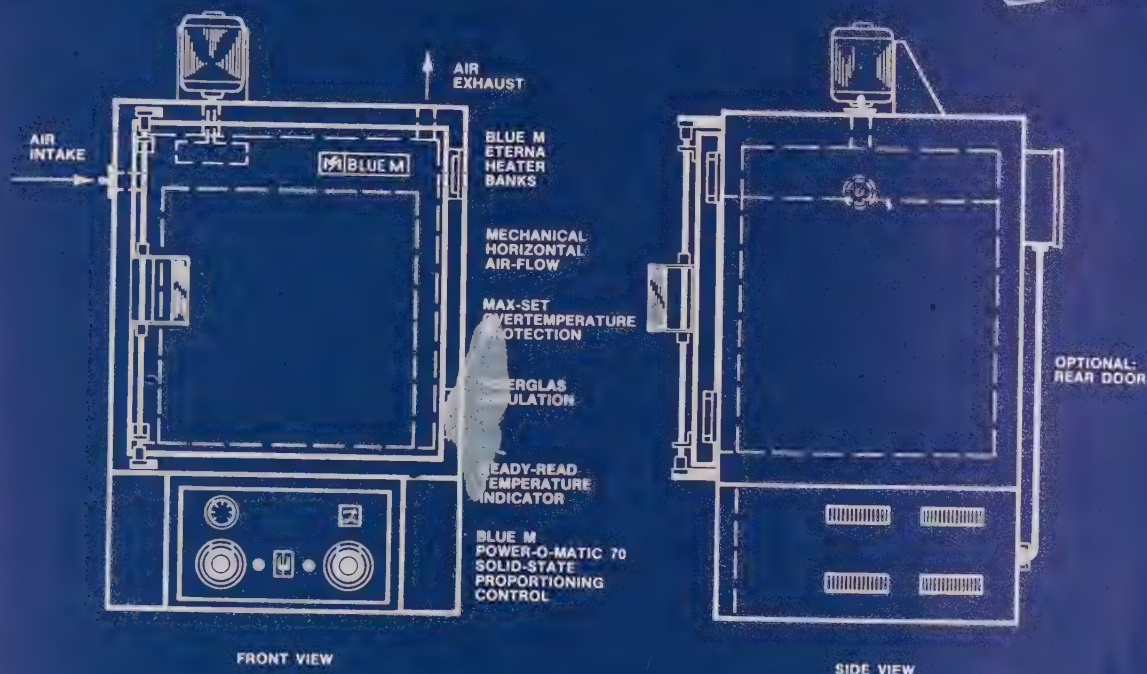
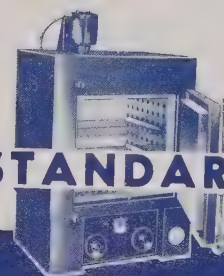
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SERVICE
PROGRAM

**BLUE M**

A BLUE M

STANDARD



READY-READ TEMPERATURE INDICATOR—3½" diameter. Stainless sensing bulb. Dual scale in C. and F.

AIR INTAKE—adjustable.

AIR EXHAUST—adjustable.

OPERATION

Set control for desired temperature. Air, heated by black heat, "controlled" low-watt density shielded ETERNA elements, propelled mechanically and horizontally for uniform heat distribution. Air changed approximately 50 times per minute. Air velocity through work space is approximately 250 F.P.M. Elements located in top section for safety from spillage. NO RADIANT HEAT.

TEMPERATURE RANGE: TO +180°C. (+356°F.)

Model Number	Inside Dimensions Inches (Cm.)			Overall Dimensions Inches (Cm.)			Total KVA	Voltage 60 Hz. A.C. 1 Phase
	W.	D.	H.	W.	D.	H.		
POM-586A-2	24	25	24	35	36	55	2.0	120V.
POM-586C-2	(61)	(63)	(61)	(88)	(90)	(139)	1 5/2 0	208 240V

TEMPERATURE RANGE: TO +260°C. (+500°F.)

POM-588C-2	24	25	24	35	36	55	3 4/4 4	208/240V
	(61)	(63)	(61)	(88)	(90)	(139)		

All wiring complete and enclosed to meet N.E. Code, as amended.
All models also available with transformer for 480V./1Ph./60 Hz. A.C.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: EXTRA SHELVES AND BRACKETS, LEAD-IN PORTS, GLASS OBSERVATION PANELS, AUTOMATIC TIMERS, FLOOR STANDS, REAR DOOR, RECORDING AND INDICATING THERMOMETERS, AND STAINLESS STEEL INTERIORS

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BLUE M EQUIPMENT

A SALES AND SERVICE BRANCH OF
BLUE M EQUIPMENT COMPANY
Corporate Headquarters: Blue Island, Illinois 60406

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Florida, Orlando 32789
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Illinois, Blue Island 60406
Massachusetts, Framingham 01701
Michigan, Allen Park 48101
New York, Elmsford 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

**BLUE M**engineered
products in**ACTION****APPLICATION:**

How to process critical loads where fast temperature run-up and rapid recovery are essential to meet accelerated production requirements with fast cool-down capabilities built-in.

OPERATING AND CONTROL CHARACTERISTICS**TEMPERATURE RANGE**

5°C. above ambient to +343°C.
(+650°F.)

RUN-UP TIME (No Load)

To maximum temperature:
30 minutes

RECOVERY TIME (No Load)

At +200°C. door open 1 minute:
4 minutes

CONTROL ACCURACY: $\pm 0.5^\circ\text{C}$.

SETABILITY: $\pm 1.0^\circ\text{C}$.

REPEATABILITY: $\pm 0.5^\circ\text{C}$.

TYPICAL AIR TEMPERATURE UNIFORMITY

At +100°C.: $\pm 1.0^\circ\text{C}$.

At +200°C.: $\pm 2.0^\circ\text{C}$.

BLUE M CERTIFICATION

All tests conducted with no load, no exhaust, and stabilized chamber under normal conditions of voltage and ambient. When unusual line voltages, ambients, severe loads and exhaust rates exist, please contact local sales offices or factory for recommendations.

BLUE M GUARANTEE

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operating requirements.

SOLUTION:**BLUE M HIGH POWERED
HIGH PRODUCTION OVENS**

with **POWER-O-MATIC 60**® Saturable Reactor Proportioning Control System.

By combining twice the normal K.W. ratings with matching air-flow design, Blue M has made available a series of ovens exceptionally well suited for increased volume and faster processing of materials. Our experience through the years indicates a real need for higher-than-normal thermal capabilities of units to insure rapid run-up and recovery with the one-pass air-flow system rapidly lowering chamber temperature to expedite handling of workloads (if required). Increased production results.

Enhancing their operational efficiency is the patented POWER-O-MATIC 60 Control providing truly straight-line, infinitely proportional performance. The inherent reliability, accuracy and dependability of this proven system make these ovens excellent for processing the most exotic products, components, or materials over the most extended periods. MAX-SET time-delay overtemperature protection safeguards valuable workloads and equipment, and elapsed time meter shows how many hours oven has operated.

These quality units are available with a choice of configurations to meet a wide variety of operational requirements. They come in seven sizes, and are either bench models (illustrated) or floor models, depending on size. +316°C. (+600°F.) chambers with typical Batch Oven configuration and similar operating characteristics are described on the following pages.

GENERAL SPECIFICATIONS**CONTROL SYSTEM**

POWER-O-MATIC 60 Saturable Reactor Proportioning Control System.

MEMORY RING® Temperature Calibrating Dial.

DIAL POINTER LOCK

MAX-SET™ OVERTEMPERATURE PROTECTION

READY-READ TEMPERATURE INDICATOR— $\frac{3}{8}$ " diameter. Stainless sensing bulb. Dual scale in C. and F.

ELAPSED TIME METER

VOLTMETER

MAIN SWITCH

PILOT LIGHT

CONSTRUCTION

HOUSING—all-welded heavy gauge cold rolled steel, reinforced.

INTERIOR—type 304, 18-8 stainless.

EXTERIOR FINISH—attractive blue enamel.

INSULATION—Fiberglas.

DOOR(S)—same construction as unit. Silicone rubber seal. All models have one door except those 38" wide or larger which have two but no center mullion.

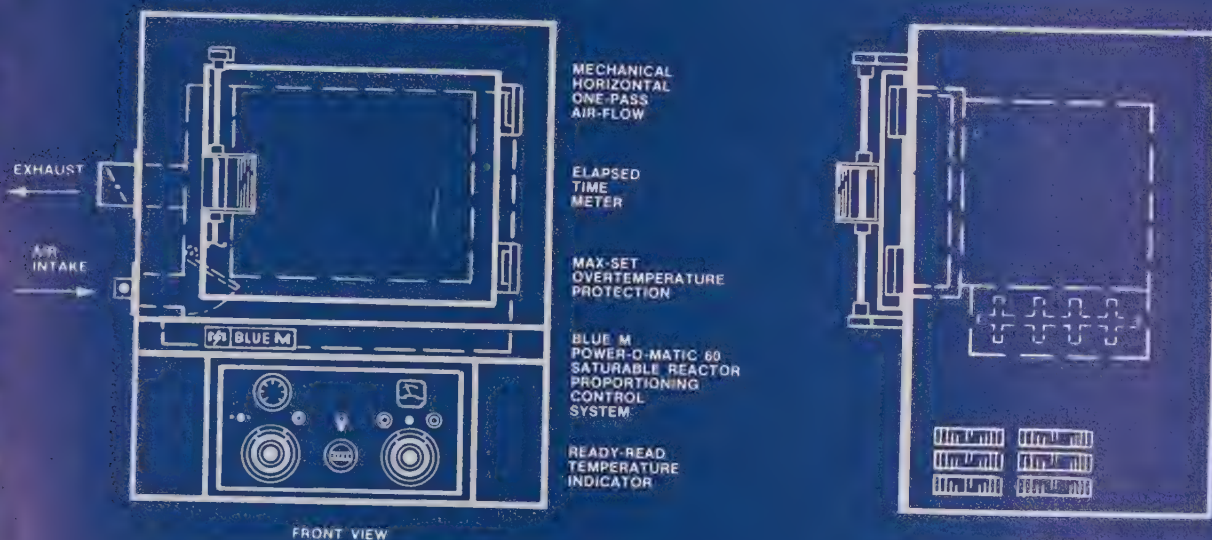
HARDWARE—exclusive, adjustable no slam, cam action latch and chrome-plated hinges.

ETERNA HEATER BANKS—cylindrical type, assure years of service.

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EXCLUSIVE

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and
REPLACEMENT
SERVICE
PROGRAM

**BLUE M**



GENERAL SPECIFICATIONS

Model Number	Inside Dimensions Inches (Cm.)			*Overall Dimensions Inches (Cm.)			Total KVA	*Voltage 60 Hz. A.C. 3 Phase	Cubic Feet Cap.
	W.	D.	H.	W.	D.	H.			
‡POM-146F-1HP	14 (35)	14 (35)	14 (35)	29 (73)	26 (65)	43 (109)	5.1	240V	1.5
‡POM-206F-1HP	20 (51)	18 (45)	20 (51)	35 (88)	30 (76)	49 (123)	9.1	240V.	4.1
‡POM-256F-1HP	25 (63)	20 (51)	20 (51)	40 (101)	32 (80)	49 (123)	9.3	240V.	5.8
POM-136F-1HP	38 (95)	20 (51)	25 (63)	53 (133)	32 (80)	62 (157)	17.9	240V	11.0
POM-336F-1HP	25 (63)	20 (51)	38 (95)	40 (101)	32 (80)	75 (190)	17.9	240V	11.0
POM-1406F-1HP	48 (120)	24 (61)	36 (90)	63 (159)	36 (90)	73 (185)	18.2	240V	24.0
POM-1506F-1HP	37 (93)	25 (63)	37 (93)	53 (133)	38 (95)	75 (190)	18.1	240V.	20.4

*Other voltages available, all models: 208 V. and 480 V./3 Ph.

Three smaller models also available for 208 V. and 240 V./1 Ph.

‡Bench models.

All wiring complete and enclosed to meet N.E. Code, as amended.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: EXTRA SHELVES, LEAD-IN PORTS, FLOOR STANDS, CASTERS, PROGRAMMING, MOTORIZED DAMPERS AND RECORDING.

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New York, Elmsford 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

APPLICATION: How to volume-process to critical standards when fast temperature run-up, recovery and cool-down capabilities are essential to accelerated production requirements.

OPERATING AND CONTROL CHARACTERISTICS

TEMPERATURE RANGE

To +316°C. (+600°F.)

MINIMUM TEMPERATURE:

5°C. above ambient with One-Pass Air-Flow operating.

RUN-UP TIME (No Load)

To maximum Temperature: 55 minutes

RECOVERY TIME (No Load)

At +200°C. door open 1 minute: 3 minutes

CONTROL ACCURACY: ±0.5°C.

SETABILITY: ±1.0°C.

REPEATABILITY: ±0.5°C.

TYPICAL AIR TEMPERATURE UNIFORMITY

At +100°C.: ±1.0°C.

At +200°C.: ±2.0°C.

BLUE M CERTIFICATION

All tests conducted with no load, no exhaust, and stabilized chamber under normal conditions of voltage and ambient. When unusual line voltages, ambients, severe loads and exhaust rates exist, please contact local sales offices or factory for recommendations.

BLUE M GUARANTEE

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operating requirements.

SOLUTION:

BLUE M BATCH TYPE HIGH POWERED HIGH PRODUCTION OVENS

with ~~POWER-O-MATIC~~ **POWER-O-MATIC 60**® Saturable Reactor Proportioning Control System.

The eight popular sizes—from 10 to 96 cubic feet—of these chambers, and their versatile +316°C. range when combined with twice the normal K.W. ratings convert these chambers of proven Blue M Batch Oven design and configuration into a series of units without equal for fast, volume processing. Higher-than-normal thermal capabilities assure rapid run-up and recovery, while the addition of a one-pass air-flow system facilitates rapid lowering of chamber temperature if needed to speed up workload handling.

Complementing their operational efficiency is the true straight-line, infinitely proportional performance of the POWER-O-MATIC 60 Control. The inherent reliability, accuracy and dependability of this patented instrumentation make these chambers more than equal to processing the most exotic products, components or materials over even extended periods. Exclusive MAX-SET overtemperature protection with unique time-delay circuitry safeguards valuable workloads and equipment. Elapsed time meter shows how long chamber has actually operated.

Other chambers with similar operating capabilities but with a range to +343°C. (+650°F.) in both bench and floor models are described on the previous pages.

GENERAL SPECIFICATIONS

CONTROL SYSTEM

POWER-O-MATIC 60 Saturable Reactor Proportioning Control System.

MEMORY RING® Temperature Calibrating Dial.

DIAL POINTER LOCK

MAX-SET™ OVERTEMPERATURE PROTECTION

INTERLOCK SWITCH—shuts off power when control panel is opened.

READY-READ TEMPERATURE INDICATOR—3½" diameter. Stainless sensing bulb. Dual scale in C. and F.

ELAPSED TIME METER

VOLTMETER

MAIN SWITCH

PILOT LIGHT

CONSOLE INSTRUMENT CABINET—houses all instrumentation on 60, 80 and 96 cu. ft. models only.

MOTOR OVERLOAD PROTECTION

CONSTRUCTION

HOUSING—all-welded heavy gauge cold-rolled steel reinforced.

INTERIOR—all-welded cold-rolled steel, aluminum paint. (Stainless optional.) Side walls removable.

EXTERIOR FINISH—attractive blue enamel.

INSULATION—Fiberglas.

DOOR(S)—same construction as unit. Silicone rubber seal. All models have one door except those 38" wide or larger which have two but no center mullion. Industrial hardware.

ETERNA HEATER BANKS—cylindrical type, assure years of service.

DIRECT DRIVE AIR CIRCULATION—quality ball bearing motor and balanced multi-bladed blower designed especially for these units. No bearing, pulley or belts.

EQUIPMENT COVERED BY

OUR EXCLUSIVE PARTS WARRANTY and REPLACEMENT SERVICE PROGRAM



MAX-SET
OVERTEMPERATURE
PROTECTION

ELAPSED
TIME
METER

EXHAUST



FRONT VIEW

BLUE M
POWER-O-MATIC 60
SATURABLE REACTOR
PROPORTIONING
CONTROL
SYSTEM

READY-READ
TEMPERATURE
INDICATOR

MECHANICAL
HORIZONTAL
ONE-PASS
AIR-FLOW

NOTE: 60, 80 AND 96
CU. FT. MODELS HAVE
CONSOLE INSTRUMENT
CABINET



SIDE VIEW

DIRECT DRIVE
MOTOR BLOWER
SYSTEM

FIBERGLAS
INSULATION

SHELF SUPPORTS—angles every 4" for models to 36 cu. ft.; 6" on larger units.

SHELVES (OPTIONAL)—heavy steel angle iron framing and expanded metal. Aluminum paint. Also available in stainless.

ADJUSTABLE ONE-PASS AIR-FLOW SYSTEM—tempered air passes over heaters and through chamber only once if necessary. Permits almost 100% exhaust, rapid pull-down.

OPERATION

Set control for desired temperature. Air, heated by black heat, "controlled" low-watt density shielded ETERNA elements, propelled mechanically and horizontally across working chamber for uniform heat distribution. Air velocity through work space is approximately 250 F.P.M. NO RADIANT HEAT.

GENERAL SPECIFICATIONS

Model Number	Inside Dimensions Inches (Cm.)			Overall Dimensions Inches (Cm.)			Total KVA	*Voltage 60 Hz. A.C. 3 Phase	Cubic Feet Cap.
	W.	D.	H.	W.	D.	H.			
POM-106FHP	19 (48)	20 (51)	39 (98)	37 (93)	31 (78)	75 (190)	12.2	240V.	10.0
POM-166FHP	24 (61)	24 (61)	48 (120)	44 (111)	37 (93)	83 (211)	17.5	240V.	16.0
POM-246FHP	36 (90)	24 (61)	48 (120)	56 (142)	37 (93)	83 (211)	17.7	240V.	24.0
POM-326FHP	48 (120)	24 (61)	48 (120)	68 (172)	37 (93)	83 (211)	24.7	240V.	32.0
POM-366FHP	36 (90)	36 (90)	48 (120)	56 (142)	49 (123)	83 (211)	24.7	240V.	36.0
POM-606FHP	36 (90)	48 (120)	60 (152)	81 (205)	61 (154)	98 (249)	33.7	240V.	60.0
POM-806FHP	48 (120)	48 (120)	60 (152)	93 (236)	61 (154)	98 (249)	33.7	240V.	80.0
POM-966FHP	48 (120)	48 (120)	72 (183)	93 (236)	61 (154)	110 (279)	48.7	240V.	96.0

*Other voltages available, all models: 208V. and 480V./3Ph.

All wiring complete and enclosed to meet N.E. Code, as amended

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: LEAD-IN PORTS, GLASS OBSERVATION PANELS, PYROMETERS, RECORDERS, THERMOMETERS, SHELVES, TIMERS, FUSED DISCONNECT SWITCHES, MOTORIZED DAMPERS, ROLL-IN RACKS AND DOLLIES, AND CASTERS.

SEND FOR ADDITIONAL INFORMATION AND ALL PRICES

BLUE M EQUIPMENT

A SALES AND SERVICE BRANCH OF
BLUE M EQUIPMENT COMPANY
Corporate Headquarters: Blue Island, Illinois 60406

Arizona, Scottsdale 85251
California, El Monte 91731
California, Sunnyvale 94086
Florida, Orlando 32789
Georgia, Atlanta 30341

Illinois, Blue Island 60406
Massachusetts, Framingham 01701
Michigan, Allen Park 48101
New York, Elmsford 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

**BLUE M**engineered
products in**ACTION****APPLICATION:**

How to successfully test/process valuable workloads to critical reliability standards in chambers of proven design excellence where uncommon voltages must be utilized.

OPERATING AND CONTROL CHARACTERISTICS**TEMPERATURE RANGES**

5°C. above ambient to +204°C.

(400°F.)

5°C. above ambient to +343°C.

(+650°F.)

CONTROL ACCURACY: $\pm 0.5^{\circ}\text{C}$.

SETABILITY: $\pm 1.0^{\circ}\text{C}$.

REPEATABILITY: $\pm 0.5^{\circ}\text{C}$.

TYPICAL AIR TEMPERATURE UNIFORMITY

$\pm 1\%$ of setpoint (with no exhaust)

BLUE M CERTIFICATION

All tests conducted with no load, no exhaust, and stabilized chamber under normal conditions of voltage and ambient. When unusual line voltages, ambients, severe loads and exhaust rates exist, please contact local sales offices or factory for recommendations.

BLUE M GUARANTEE

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operating requirements.

SOLUTION:**BLUE M MECHANICAL CONVECTION, HORIZONTAL AIR-FLOW OVENS**

with ~~POWER-O-MATIC 60~~ **POWER-O-MATIC 60**® Saturable Reactor Proportioning Control System.

Blue M has taken what are unquestionably among the finest Mechanical Convection Ovens ever developed and reengineered them for operation in facilities having unusual electrical service. In so doing, Blue M has brought chamber design and performance generally acknowledged as being incomparable to test/production departments with 208 V., 240 V. or 480 V./3 Phase power.

Available with a choice of versatile temperature ranges, in bench or floor types and in popular chamber sizes of 1.6, 4.1, 5.8, 10.0 and 24.0 cubic feet, these ovens feature the patented POWER-O-MATIC 60 Control. The inherent reliability, accuracy and dependability of the truly straight-line, infinitely proportional performance of this instrumentation enables these chambers to be used for the most critical work—including processing exotic and costly parts and components over long periods. MAX-SET time-delay overtemperature protection safeguards workloads and equipment against excessive temperature rise. Advanced design of these chambers is indicated by the special sliding drawer upon which are mounted practically all components and the control panel. The entire assembly can be pulled forward, providing complete access to all parts.

It should be noted that while these fine ovens are designed for unusual power requirements, they are also available for such more common service as 120 V., 208 V. and 240 V./1 Phase operation. The drawings on the opposite page show a typical bench model, the photograph a typical floor model.

GENERAL SPECIFICATIONS**CONTROL SYSTEM**

POWER-O-MATIC 60 Saturable Reactor Proportioning Control System.

MEMORY RING® Temperature Calibrating Dial.

DIAL POINTER LOCK

MAX-SET™ OVERTEMPERATURE PROTECTION

READY-READ TEMPERATURE INDICATOR— $3\frac{1}{2}$ " diameter. Stainless sensing bulb. Dual scale in C. and F.

ELAPSED TIME METER

VOLTMETER

MAIN SWITCH

PILOT LIGHT**CONSTRUCTION**

HOUSING—all-welded heavy gauge cold rolled steel, reinforced.

INTERIOR—type 304, 18-8 stainless.

EXTERIOR FINISH—attractive blue enamel.

INSULATION—Fiberglas.

DOOR(S)—same construction as unit. Silicone rubber seal. All models have one door except those 38" wide or larger which have two but no center mullion.

HARDWARE—exclusive, adjustable no slam, cam action latch and chrome-plated hinges.

ETERNA HEATER BANKS—cylindrical type, assure years of service.

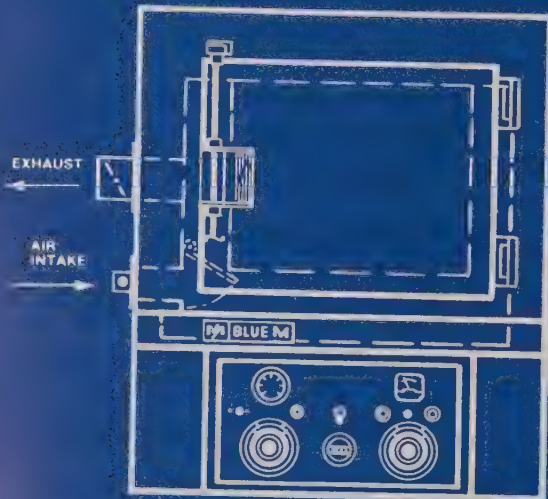
EQUIPMENT COVERED BY
OUR
EXCLUSIVE

PARTS
WARRANTY
and
REPLACEMENT
SERVICE
PROGRAM

**BLUE M**

A BLUE M

STANDARD



FRONT VIEW

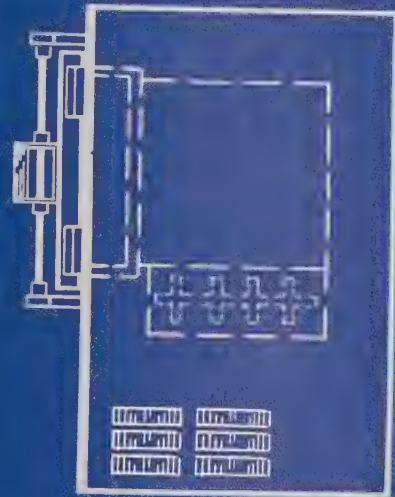
MECHANICAL
HORIZONTAL
ONE-PASS
AIR-FLOW

ELAPSED
TIME
METER

MAX-SET
OVERTEMPERATURE
PROTECTION

BLUE M
POWER-O-MATIC 50
SATURABLE REACTOR
PROPORTIONING
CONTROL
SYSTEM

READY-READ
TEMPERATURE
INDICATOR



SIDE VIEW

AIR CIRCULATION—quality ball bearing motor and balanced multi-bladed blower designed especially for these units

SHELVES two, wire rod or expanded type. Nickel-plated, adjustable on 2" centers (Stainless optional).

ADJUSTABLE ONE-PASS AIR-FLOW SYSTEM—tempered air passes over heaters and through chamber only once if necessary. Permits almost 100% exhaust, rapid pull-down.

OPERATION

Set control for desired temperature. Air, heated by black heat, "controlled" low-watt density shielded ETERNA elements, propelled mechanically and horizontally across working chamber for uniform heat distribution. Air velocity through work space is approximately 250 F.P.M. NO RADIANT HEAT.

Model numbers and typical characteristics shown for +343°C. (+650°F.) range only. Units with range to +204°C. (+400°F.) have similar I.D. and O.D. but total KVA decreases according to temperature range. Write for details

GENERAL SPECIFICATIONS

Model Number	Inside Dimensions Inches (Cm.)			Overall Dimensions Inches (Cm.)			Total KVA	*Voltage 60 Hz. A.C. 3 Phase	Cubic Feet Cap.
	W.	D.	H.	W.	D.	H.			
+POM-146F-1	14 (35)	14 (35)	14 (35)	29 (73)	26 (65)	43 (108)	2.8	240V.	1.6
+POM-206F-1	20 (51)	18 (45)	20 (51)	35 (88)	30 (76)	49 (123)	3.9	240V.	4.1
+POM-256F-1	25 (63)	20 (51)	20 (51)	40 (101)	32 (80)	49 (123)	5.2	240V.	5.8
POM-136F-1	38 (95)	20 (51)	25 (63)	53 (133)	32 (80)	62 (157)	9.5	240V.	10.0
POM-336F-1	25 (63)	20 (51)	38 (95)	40 (101)	32 (80)	75 (190)	9.5	240V.	10.0
POM-1406F-1	48 (120)	24 (61)	36 (90)	63 (159)	36 (90)	73 (185)	9.8	240V.	24.0

*Other voltages available, all models: 208V. and 480V./3 Ph

†Bench models

All wiring complete and enclosed to meet N.E. Code, as amended

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: EXTRA SHELVES, LEAD-IN PORTS, TIMERS, CASTERS, GLASS OBSERVATION PANELS, PROGRAMMING AND RECORDING

SEND FOR ADDITIONAL INFORMATION AND ALL PRICES

BLUE M EQUIPMENT

A SALES AND SERVICE BRANCH OF
BLUE M EQUIPMENT COMPANY
Corporate Headquarters: Blue Island, Illinois 60406

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New York, Elmsford 10523
New York, Syracuse 13206

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Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
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Washington, Seattle 98108

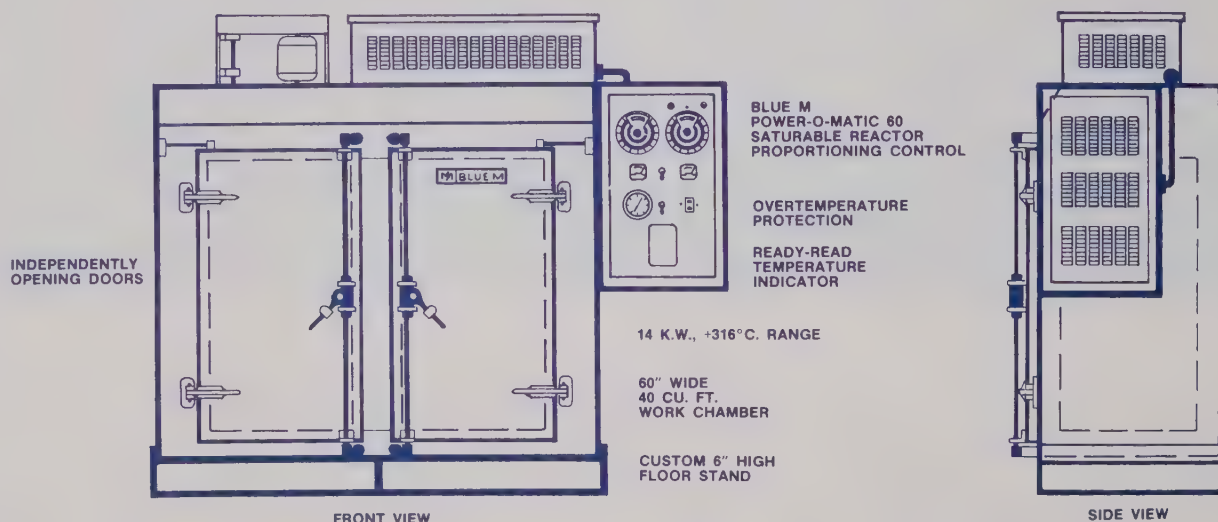
APPLICATION: How to obtain an oven of unusual or special configuration to fit a particular test/processing requirement and still be assured of unmatched reliability.

SOLUTION:

**BLUE M CUSTOMIZED
INDUSTRIAL BATCH OVENS**

The Blue M Industrial Batch Ovens described on earlier pages, while offering a number of optional features to make them suitable for specialized work, are only available in certain sizes and with certain dimensions. This standardized construction of 10, 16, 24, 32, 36, 60, 80 and 96 cubic feet work chambers represents the most popular sizes—the ones that fit the great majority of applications. Such standardization enables Blue M to keep construction costs at a minimum without compromising quality. The customer gets the greatest possible value for his money.

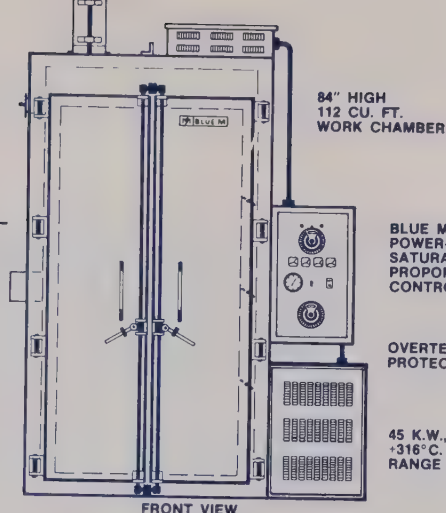
Occasionally, however, an application arises where a special configuration is needed—the oven must be higher, wider or deeper than standard. Naturally, Blue M can supply it—quickly and economically, and can include any desired optional features available on our standard units. A few such typical modifications of standard units are shown here and on the next page.



This Blue M Industrial Batch Oven, with standard I.D. of 48" W. x 24" D. x 48" H. and a working volume of 32 cu. ft., has been widened to an I.D. width of 60". It offers a working volume of 40 cu. ft. Even the largest Blue M Batch Ovens which are equipped with two doors do not have center mullions. These are ordinarily avoided so that access to the interior is unimpeded. In this case, however, the customer requested a center mullion fitted with shelf supports to match those on the inner chamber walls. The doors open independently of each other, enabling trays and/or workloads to be handled on one side without disturbing the others on the opposite side.

Additional modifications include: mounting of all controls on right side wall of oven instead of in top as is standard; special 6" high angle iron floor stand; safety switches on independently opening doors shut off heater banks and blower when either door is opened; a 24-hour timer can be set to shut off heaters while blower continues to operate; direct line over-temperature protection is installed.

The oven is equipped with the patented POWER-O-MATIC 60® Saturable Reactor Proportioning Control, is rated at 14 K.W., and operates on 240 V./3 Ph./60 Hz. A.C. It has a temperature range to +316°C. (+600°F.).

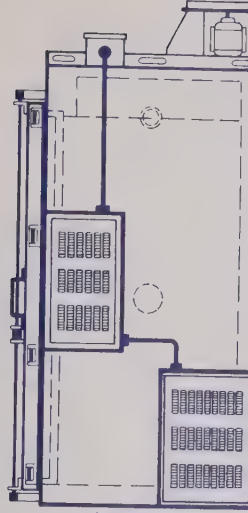


BLUE M
POWER-O-MATIC 60
SATURABLE REACTOR
PROPORTIONING
CONTROL

OVERTEMPERATURE
PROTECTION

45 K.W.,
+316° C.
RANGE

FRONT VIEW

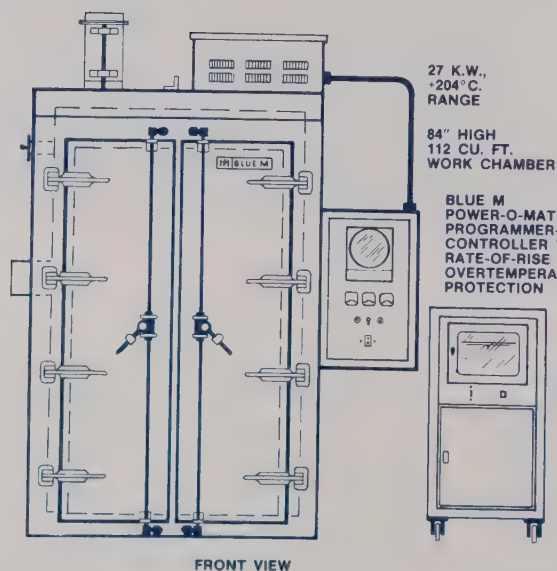


SIDE VIEW

These two examples show how Blue M Industrial Batch Ovens can be customized by adding height. Both have standard I.D.'s of 48" W. x 48" D. x 72" H. (96 cu. ft. work volume) and both have been modified to provide an 84" height (112 cu. ft. work volume). Both feature Blue M's POWER-O-MATIC 60 Control.

Besides the added work chamber height, this oven has the following modifications: a special console on the right side to house three 15 KW reactors; direct line overtemperature protection; three adjustable air-flow dampers have been installed in right plenum chamber.

The unit has a temperature range to +316° C. (+600° F.) and operates at 480 V./3 Ph./60 Hz. A.C.



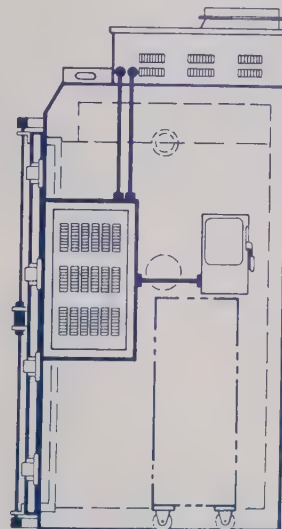
27 K.W.,
+204° C.
RANGE

84" HIGH
112 CU. FT.
WORK CHAMBER

BLUE M
POWER-O-MATIC 60
PROGRAMMER-
CONTROLLER WITH
RATE-OF-RISE
OVERTEMPERATURE
PROTECTION

SEPARATE
MONITORING
RECORDER

FRONT VIEW



SIDE VIEW

This 84" high I.D. oven is equipped with the POWER-O-MATIC 60 Programmer-Controller and separate monitoring recorder installed in a separate instrument console. The programmer has a 48-hour rotation and provides Rate-of-Rise Overtemperature Protection (see page 21 for full description). The system automatically shuts off the unit at the end of the program cycle.

The oven has a temperature range to +204° C. (+400° F.), is rated at 27 K.W., and operates on 240 V./3 Ph./60 Hz. A.C.

If you have need of an industrial Batch Oven of unusual size or configuration, please keep these examples in mind. Or better still, contact your nearest Blue M office or the factory with an outline of your requirements. Your inquiry will receive our prompt attention.

BLUE M EQUIPMENT

A SALES AND SERVICE BRANCH OF
BLUE M EQUIPMENT COMPANY
Corporate Headquarters Blue Island, Illinois 60406

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Florida, Orlando 32789
Georgia, Atlanta 30341

Illinois, Blue Island 60406
Massachusetts, Framingham 01701
Michigan, Allen Park 48101
New York, Elmsford 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

**BLUE M**engineered
products in**ACTION****APPLICATION:**

How to process dozens of small quantities of components or parts safely, dependably and economically with minimum capital expenditure.

OPERATING AND CONTROL CHARACTERISTICS**TEMPERATURE RANGE**

15°C. above ambient to +288°C.
(+550°F.)

RUN-UP TIME (No Load)

To Maximum: 60 minutes.

CONTROL ACCURACY: $\pm 0.5^{\circ}\text{C}$.**SETABILITY:** $\pm 1.0^{\circ}\text{C}$.**REPEATABILITY:** $\pm 0.5^{\circ}\text{C}$.**TYPICAL AIR TEMPERATURE UNIFORMITY**

At +100°C.: $\pm 1.0^{\circ}\text{C}$.

BLUE M CERTIFICATION

All tests conducted with no load, no exhaust, and stabilized chamber under normal conditions of voltages and ambient. When unusual line voltages, ambients, severe loads and exhaust rates exist, please contact local sales offices or factory for recommendations.

BLUE M GUARANTEE

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operating requirements.

SOLUTION:**BLUE M MINIATURE 3 DRAWER BATCH OVENS (BENCH-TYPE)**

with **POWER-O-MATIC 60**® Saturable Reactor Proportioning Control System

Blue M Mechanical Convection, Horizontal Air-Flow 3 Drawer Batch Ovens provide the electronic industry and related fields with a compact reliable means to test and process small quantities of parts and components. Drawers serve as three separate "work areas", permitting multiple production of such products as resistors and transistors. Fixtures for setting up special tests or procedures may be installed. Lead-in port in the back wall of oven or in drawer frontal-section to make direct electrical connections at each drawer level are available when specified. The units are also well suited for aging, drying, pre-heating, curing and baking steel, rubber, plastic and other materials. POWER-O-MATIC 60 Control assures unmatched reliability, accuracy and dependability. Overtemperature protection, now standard, safeguards workload and equipment. Larger 5 Drawer Ovens with POWER-O-MATIC 60 Control are described elsewhere in this section.

GENERAL SPECIFICATIONS**CONTROL SYSTEM**

POWER-O-MATIC 60 Saturable Reactor Proportioning Control System.

MEMORY RING® Temperature Calibrating Dial.

DIAL POINTER LOCK

MAX-SET™ OVERTEMPERATURE PROTECTION

READY-READ TEMPERATURE INDICATOR— $3\frac{1}{2}$ " diameter. Stainless sensing bulb. Dual scale in C. and F.

VOLTMETER

MAIN SWITCH

PILOT LIGHT

CONSTRUCTION

HOUSING—all-welded heavy gauge cold rolled steel, reinforced.

WALLS—triple side walls.

INTERIOR—type 304, 18-8 stainless.

EXTERIOR FINISH—attractive blue enamel.

INSULATION—Fiberglas.

DRAWERS—heavy gauge steel, perforated sides and bottom for balanced air-flow. Aluminum paint. Each sealed individually by silicone gasket around perimeter through lock-tight insulated handles. Drawers slide on rollers with hold-down plates to prevent tilting. Drawer stop.

DRAWER HARDWARE—exclusive adjustable no-slam, cam action latches. Chrome-plated.

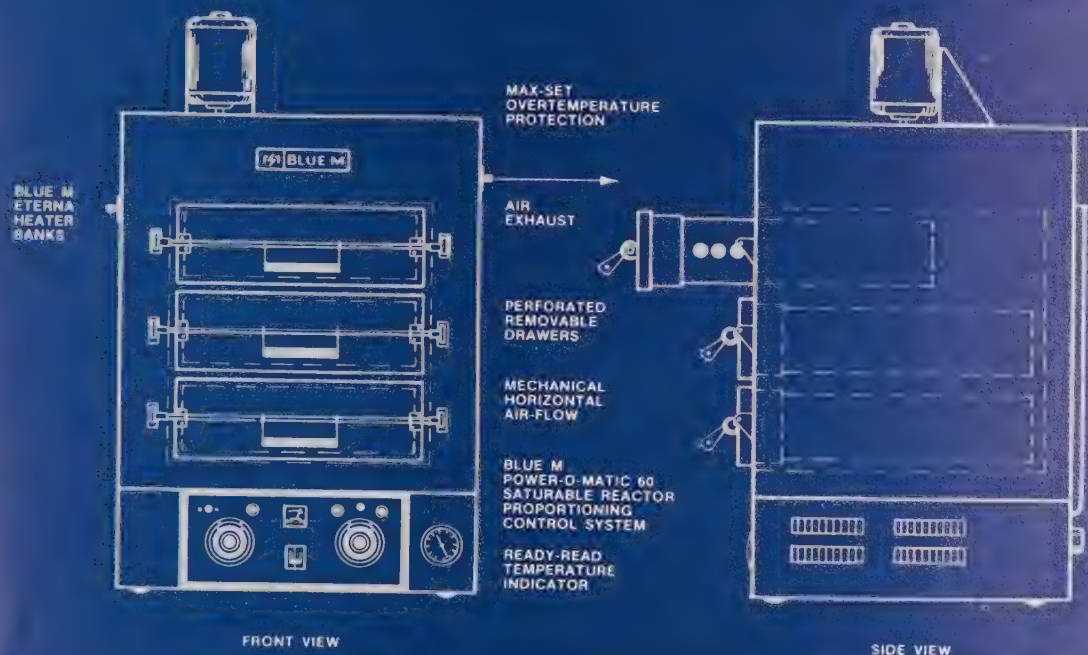
EQUIPMENT COVERED BY
OUR
EXCLUSIVE

PARTS
WARRANTY
and
REPLACEMENT
SERVICE
PROGRAM

**BLUE M**

A BLUE M

STANDARD



ETERNA HEATER BANKS—cylindrical type, assure years of service.

AIR CIRCULATION—quality ball bearing motor and balanced multi-bladed blower designed especially for these units.

AIR INTAKE—adjustable.

AIR EXHAUST—adjustable.

OPERATION

Set control for desired temperature. Air, heated by "controlled" low-watt density shielded ETERNA elements, propelled mechanically and horizontally across each of the 3 drawers for uniform heat distribution. Elements at top of unit for maximum safety. NO RADIANT HEAT.

GENERAL SPECIFICATIONS

Model Number	Inside Dimensions Inches (Cm.)			Overall Dimensions Inches (Cm.)			Total KVA	Voltage 60 Hz. A.C. 1 Phase
	W.	D.	H.	W.	D.	H.		
POM-576B-1	15 $\frac{1}{2}$	19	3 $\frac{1}{2}$	29	29	48	4.8	208V
POM-576C-1	(40)	(48)	(9)	(73)	(73)	(120)	4.8	240V

All wiring complete and enclosed to meet N.E. Code, as amended.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: LEAD-IN PORTS, EXTRA DRAWERS, AUTOMATIC TIMERS, RECORDERS, PROGRAMMERS, AND FLOOR STANDS.

SEND FOR ADDITIONAL INFORMATION AND ALL PRICES

BLUE M EQUIPMENT

A SALES AND SERVICE BRANCH OF
BLUE M EQUIPMENT COMPANY
Corporate Headquarters: Blue Island, Illinois 60405

Arizona, Scottsdale 85251
California, El Monte 91731
California, Sunnyvale 94086
Florida, Orlando 32789
Georgia, Atlanta 30341

Illinois, Blue Island 60406
Massachusetts, Framingham 01701
Michigan, Allen Park 48101
New York, Elmsford 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

APPLICATION:

How to continuously, efficiently and reliably process thousands of small parts—all of one kind or in combination—without a costly, space-wasting battery of conventional ovens.

OPERATING AND CONTROL CHARACTERISTICS

TEMPERATURE RANGES

5° C. above ambient to +204° C.
 (+400° F.)

5° C. above ambient to +288° C.
 (+550° F.)

RUN-UP TIME (No Load)

To Maximum: 60 minutes.

CONTROL ACCURACY: $\pm 0.5^{\circ}\text{C}$.

SETABILITY: $\pm 1.0^{\circ}\text{C}$.

REPEATABILITY: $\pm 0.5^{\circ}\text{C}$.

TYPICAL AIR TEMPERATURE UNIFORMITY

At +200° C.: $\pm 3.0^{\circ}\text{C}$.

BLUE M CERTIFICATION

All tests conducted with no load, no exhaust, and stabilized chamber under normal conditions of voltage and ambient. When unusual line voltage, ambients, severe loads and exhaust rates exist, please contact local sales offices or factory for recommendations.

BLUE M GUARANTEE

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operating requirements.

SOLUTION:

BLUE M 5 DRAWER OVENS

with ~~POWER-O-MATIC 60~~ ^{PATENTED} **POWER-O-MATIC 60®** Saturable Reactor Proportioning Control System.

Blue M Mechanical Convection, Horizontal Air-Flow 5 Drawer Ovens have been developed specifically to help electronic component manufacturers and other small parts processors increase production and reduce costs by replacing conventional ovens. The speed, efficiency and reliability of these ovens often enable a single compact unit to process a greater volume than a whole battery of ovens—yet accomplish it in much less space and at much lower cost. The low initial investment in these Blue M Ovens is quickly made up by increased production and lower per-part processing expense.

Ideal for continuous processing of small components or parts of steel, rubber, plastic, etc. Also for aging, curing, drying, baking, preheating plastics and synthetic finish baking. As many as five different runs of small parts—one in each drawer—can be processed simultaneously, greatly improving production flexibility. Overtemperature protection, now standard, safeguards workload and equipment. Elapsed time meter shows how long unit has actually operated.

Smaller, 3 Drawer Batch ovens with POWER-O-MATIC 60 Control are described on the previous page.

GENERAL SPECIFICATIONS

CONTROL SYSTEM

POWER-O-MATIC 60 Saturable Reactor
 Proportioning Control System

MEMORY RING® Temperature Calibrating Dial

DIAL POINTER LOCK

MAX-SET™ OVERTEMPERATURE PROTECTION

READY-READ TEMPERATURE INDICATOR— $3\frac{1}{2}$ " diameter. Stainless sensing bulb. Dual scale in C. and F.

ELAPSED TIME METER

VOLTMETER

MAIN SWITCH

PILOT LIGHT

CONSTRUCTION

HOUSING—all-welded #14 and #16 gauge cold rolled steel, reinforced.

WALLS—triple side walls.

INTERIOR FINISH—aluminum paint.

EXTERIOR FINISH—attractive blue enamel.

INSULATION—Fiberglas.

DRAWERS—heavy gauge steel, perforated sides and bottom for balanced air-flow. Aluminum paint. Each sealed individually by silicone rubber gasket around perimeter through lock-tight insulated handles. Drawers slide on runners with hold-down plates to prevent tilting.

DRAWER HARDWARE—exclusive adjustable no-slam, cam action latches. Helps assure tight seal.

EQUIPMENT COVERED BY

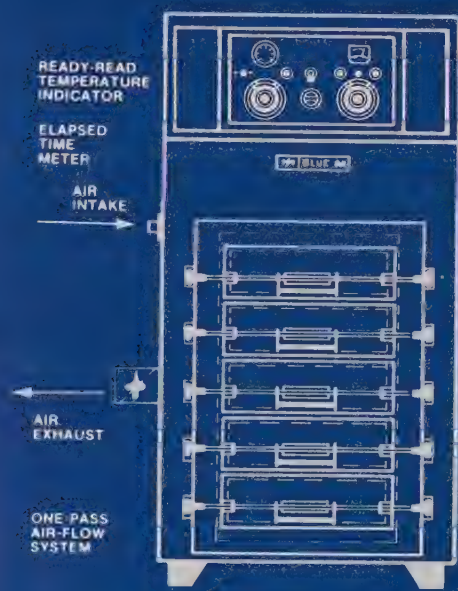
OUR EXCLUSIVE

PARTS
 WARRANTY
 and
 REPLACEMENT
 SERVICE
 PROGRAM



A BLUE M

STANDARD



FRONT VIEW

BLUE M
POWER-O-MATIC 60
SATURABLE REACTOR
PROPORTIONING
CONTROL SYSTEM WITH
MAX-SET
OVERTEMPERATURE
PROTECTION

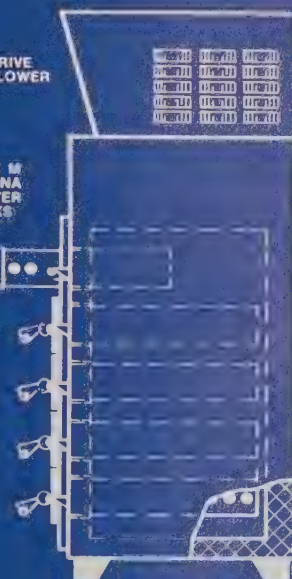
DIRECT DRIVE
MOTOR/BLOWER
SYSTEM

BLUE M
ETERNA
HEATER
BANKS

ONE DRAWER SHOWN
PARTIALLY REMOVED

MECHANICAL
HORIZONTAL
AIR-FLOW

FIBERGLAS
INSULATION



SIDE VIEW

ETERNA HEATER BANKS—cylindrical type, assure years of service.

DIRECT DRIVE AIR CIRCULATION—quality ball bearing motor and balanced multi-bladed blower designed especially for these units. No bearings, pulleys or belts.

ADJUSTABLE ONE-PASS AIR-FLOW SYSTEM—tempered air passes over heaters and through chamber only once if necessary. Permits approximate 100% exhaust. Higher K.W. rating may be required for maximum temperature if higher exhaust rate is needed

OPERATION

Set control for desired temperature. Air, heated by black heat, "controlled" low-watt density shielded ETERNA elements, propelled mechanically and horizontally across each of the drawers for uniform heat distribution. Elements at top of unit for maximum safety. Air changed approximately 50 times per minute. Air velocity through work space is approximately 250 F.P.M. NO RADIANT HEAT.

TEMPERATURE RANGE: TO $+204^{\circ}\text{C. (+400}^{\circ}\text{F.)}$

Model Number	Inside Dimensions Inches (Cm.)			Overall Dimensions Inches (Cm.)			Total KVA	Voltage 60 Hz. A.C. 3 Phase
	W.	D.	H.	W.	D.	H.		
POM-5613E-1	18½ (46)	20 (51)	5 (12)	37 (93)	31 (78)	75 (190)	5.3	208V
POM-5613F-1							5.3	240V.

TEMPERATURE RANGE: TO $+288^{\circ}\text{C. (+550}^{\circ}\text{F.)}$

POM-5616E-1	18½ (46)	20 (51)	5 (12)	37 (93)	31 (78)	75 (190)	9.2	208V
POM-5616F-1							9.2	240V.

All wiring complete and enclosed to meet N.E. Code, as amended.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: LEAD-IN PORTS, RECORDING AND INDICATING THERMOMETERS, AIR-FLOW SWITCH, EXTRA DRAWERS AND AUTOMATIC TIMERS.

SEND FOR ADDITIONAL INFORMATION AND ALL PRICES

BLUE M EQUIPMENT

A SALES AND SERVICE BRANCH OF
BLUE M EQUIPMENT COMPANY
Corporate Headquarters: Blue Island, Illinois 60406

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California, Sunnyvale 94086
Florida, Orlando 32789
Georgia, Atlanta 30341

Illinois, Blue Island 60406
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New York, Elmsford 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
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**BLUE M**engineered
products in**ACTION****APPLICATION:**

How to conveniently and efficiently test and/or process small parts and components for varying periods and levels in a single unit without sacrifice of recovery rate.

OPERATING AND CONTROL CHARACTERISTICS**TEMPERATURE RANGES**

5°C. above ambient to +204°C.
(+400°F.)

5°C. above ambient to +316°C.
(+600°F.)

RUN-UP TIME (No Load)

90 minutes.

CONTROL ACCURACY: $\pm 0.5^{\circ}\text{C}$.

SETABILITY: $\pm 1.0^{\circ}\text{C}$.

REPEATABILITY: $\pm 0.5^{\circ}\text{C}$.

TYPICAL AIR TEMPERATURE UNIFORMITY

At +200°C.: $\pm 2.0^{\circ}\text{C}$.

BLUE M CERTIFICATION

All tests conducted with no load, no exhaust, and stabilized chamber under normal conditions of voltage and ambient. When unusual line voltages, ambients, severe loads and exhaust rates exist, please contact local sales offices or factory for recommendations.

BLUE M GUARANTEE

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operating requirements.

SOLUTION:**BLUE M 5 DOOR AND 5 SHELF OVENS**

with **POWER-O-MATIC 60**® **Saturable Reactor Proportioning Control System.**

Blue M Mechanical Convection, Horizontal Air-Flow 5 Door and 5 Shelf Ovens provide simple, efficient means to test or process components to exacting requirements while assuring almost unlimited flexibility. Five separate work levels enable different types of components to be processed in each. In addition, length of process time can be varied simply by leaving workloads in their respective levels as long as necessary. The contents of any level can be removed and replaced at any time without disturbing the others and without upsetting the uniformity or recovery rate of the oven.

Each of the 5 levels is, in effect, an individual chamber, each with its own fixed mullion door, and removable shelf. Heavily insulated doors and hinges, plus positive door latches permit frequent random loading/unloading of components as needed. Unit blower and heater design assures proper horizontal air convection across each shelf with superior uniformity of heated components. The inherent accuracy and reliability of the POWER-O-MATIC 60 Control offer performance characteristics that more than meet today's rigid test requirements. MAX-SET overtemperature protection, now standard, safeguards workload and equipment.

GENERAL SPECIFICATIONS**CONTROL SYSTEM**

POWER-O-MATIC 60 Saturable Reactor Proportioning Control System.

MEMORY RING® Temperature Calibrating Dial.

DIAL POINTER LOCK

MAX-SET™ **OVERTEMPERATURE PROTECTION**

READY-READ TEMPERATURE INDICATOR—3½" diameter. Stainless sensing bulb. Dual scale in C. and F.

ELAPSED TIME METER

VOLTMETER

PILOT LIGHTS

CONSTRUCTION

HOUSING—all-welded #14 and #16 gauge cold rolled steel, reinforced. Heavy front plate.

WALLS—triple side walls.

INTERIOR FINISH—aluminum paint.
(Stainless optional.)

EXTERIOR FINISH—attractive blue enamel.
(Stainless optional.)

INSULATION—Fiberglas.

ETERNA HEATER BANKS—cylindrical type, assure years of service.

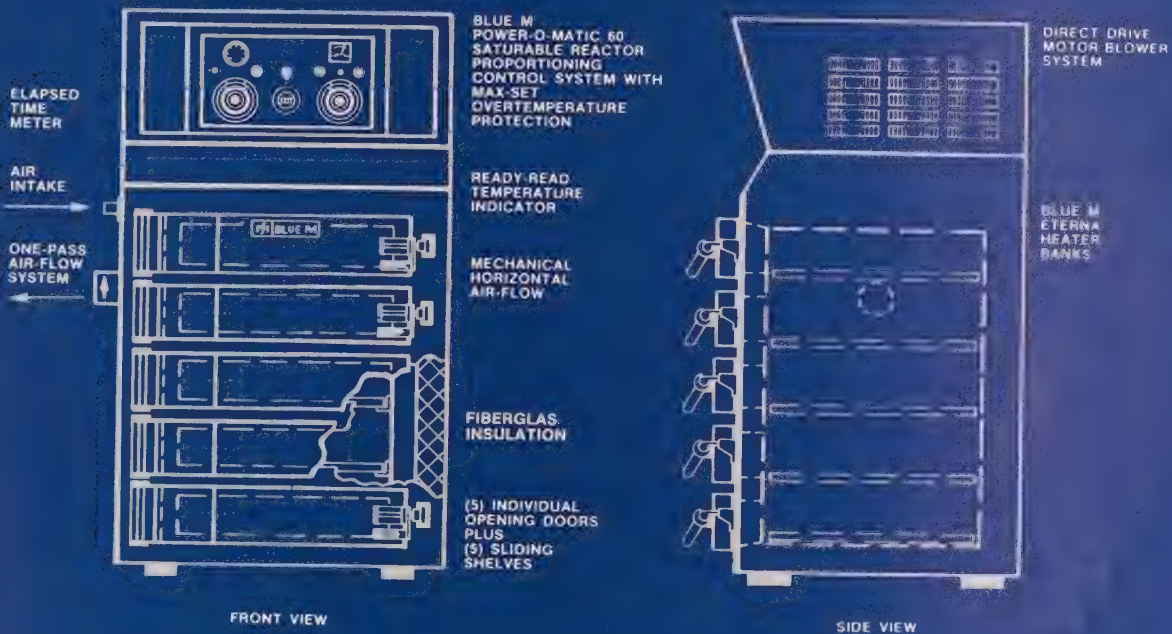
DIRECT DRIVE AIR CIRCULATION—quality ball bearing motor and balanced multi-bladed blower designed especially for these units. No bearings pulleys or belts. Front mounted air damper regulator.

(5) LEVELS—all-welded cold-rolled steel. (Stainless optional.) Each 7" high and equipped with a sliding shelf to facilitate loading and unloading. 24" or 36" wide x 24" deep depending on model.

EQUIPMENT COVERED BY**OUR EXCLUSIVE**

PARTS
WARRANTY
and
REPLACEMENT
SERVICE
PROGRAM

**BLUE M**



DOORS—double wall type, insulation and construction same as unit. Open wide to provide full access to interior. Heavy-duty hinges and latches lock doors against silicone rubber seals for tight closure.

ADJUSTABLE ONE-PASS AIR-FLOW SYSTEM—tempered air passes over heaters and through chamber only once if necessary. Permits almost 100% exhaust. Higher K.W. rating may be required for maximum temperature if high exhaust rate is needed.

OPERATION

Set control for desired temperature. Air, heated by black heat, "controlled" low-watt density shielded ETERNA elements, propelled mechanically and horizontally across working chamber for uniform heat distribution around all compartments. Air changed approximately 50 times per minute. Air velocity through work space is approximately 250 F.P.M. NO RADIANT HEAT.

GENERAL SPECIFICATIONS TEMPERATURE RANGE: TO +204°C. (+400°F.)

Model Number	Level Openings Inches (Cm.)			Overall Dimensions Inches (Cm.)			Total KVA	Voltage 60 Hz. A.C. 3 Phase
	W.	D.	H.	W.	D.	H.		
POM-5164F	24 (61)	24 (61)	7 (18)	41 (104)	37 (93)	83 (211)	10.0	240V
POM-5244F	36 (90)	24 (61)	7 (18)	53 (133)	37 (93)	83 (211)	10.0	240V

TEMPERATURE RANGE: TO +316°C. (+600°F.)

POM-5166F	24 (61)	24 (61)	7 (18)	41 (104)	37 (93)	83 (211)	13.4	240V
POM-5246F	36 (90)	24 (61)	7 (18)	53 (133)	37 (93)	83 (211)	14.4	240V

Other voltages available, all models: 208 and 480 V./3 Ph.
All wiring complete and enclosed to meet N.E. Code, as amended.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: RECORDERS, TIMERS, CASTERS, EXTRA SHELVES, AIR-FLOW SWITCH, AND LEAD-IN PORTS.

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New York, Elmsford 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

APPLICATION:

How to select a single oven suitable for both reliable long term life-testing and for short term operation where fast run-up and pull-down times are needed.

OPERATING AND CONTROL CHARACTERISTICS

TEMPERATURE RANGE

+38°C. to +260°C. (+500°F.)

TYPICAL AIR TEMPERATURE UNIFORMITY

(No Exhaust)

At +100°C.: $\pm 1.0^\circ\text{C}$.

At +250°C.: $\pm 2.0^\circ\text{C}$.

(Max. Exhaust)

At +100°C.: $\pm 1.5^\circ\text{C}$.

At +250°C.: $\pm 3.0^\circ\text{C}$.

RUN-UP TIME TO +260°C.

(No Load)

	240V.	208V.
No Exhaust:	15 min.	20 min.
Max. Exhaust:	20 min.	40 min.
(With 50# Steel Load)		
No Exhaust:	75 min.	80 min.
Max. Exhaust:	85 min.	130 min.

COOL-DOWN FROM +260°C.

MAX. EXHAUST

(No Load)

To +150°C.: 10 minutes

To + 50°C.: 41 minutes

EXHAUST CAPACITY IN CFM

	240V.	208V.
At +100°C.:	40	35
At +150°C.:	27	25
At +200°C.:	22	20
At +260°C.:	13	10

SOLUTION:

BLUE M HIGH POWERED LIFE-TEST OVENS

with ~~POWER-O-MATIC-70~~^{PAIINTED} **Solid-State Proportioning Control System and Built-in Overtemperature Protection.**

This new mechanical convection horizontal air-flow oven is really two chambers in one. The POWER-O-MATIC 70 Control provides reliable straight-line temperature performance, making the oven ideal for extended life-testing work. Yet the unit's high K.W. rating and one-pass air-flow system also enables it to serve those applications where fast run-up and pull-down rates are required. The one-pass air-flow system—which allows incoming air to pass over the heaters and through the work chamber only once if desired—also makes this oven excellent for processing parts or components.

The oven includes a number of quality features as standard including built-in overtemperature protection and fused main disconnect switch for safety. It is also U.L. Listed.

An elapsed time meter verifies the actual number of hours the unit has operated. Further evidence of the oven's overall quality is the fact that the average skin temperature when operating at +260°C. is only 53°C. This oven may be connected to either 240 V. or 208 V. line with wattage and run-up times as specified.

In applications where this U.L. Listed oven is to be used specifically for life-testing involving wattage dissipation of live loads, please contact factory for recommendations regarding safety feature accessories and wattage dissipation applications.

GENERAL SPECIFICATIONS

CONTROL SYSTEM

POWER-O-MATIC 70 Solid-State
Proportioning Control system

BUILT-IN OVERTEMPERATURE PROTECTION

MEMORY RING® Temperature Calibrating Dial

DIAL POINTER LOCK

ELAPSED TIME METER

READY-READ TEMPERATURE INDICATOR— $3\frac{1}{2}$ " diameter. Stainless sensing bulb. Dual scale in degrees C. and F.

VOLTMETER

MAIN FUSED DISCONNECT SWITCH

MAIN SWITCH

PILOT LIGHT

CONSTRUCTION

HOUSING—all-welded heavy gauge cold rolled steel reinforced.

WALLS—triple side walls.

INTERIOR—type 302 stainless, 2B finish, including inner face of door.

EXTERIOR FINISH—attractive blue enamel.

INSULATION—Fiberglas.

DOOR—double wall type, insulation and construction same as unit. Silicone rubber seal.

HARDWARE—exclusive adjustable no-slam cam action latch and chrome-plated hinges.

ETERNA HEATER BANKS—cylindrical type, assure years of service.

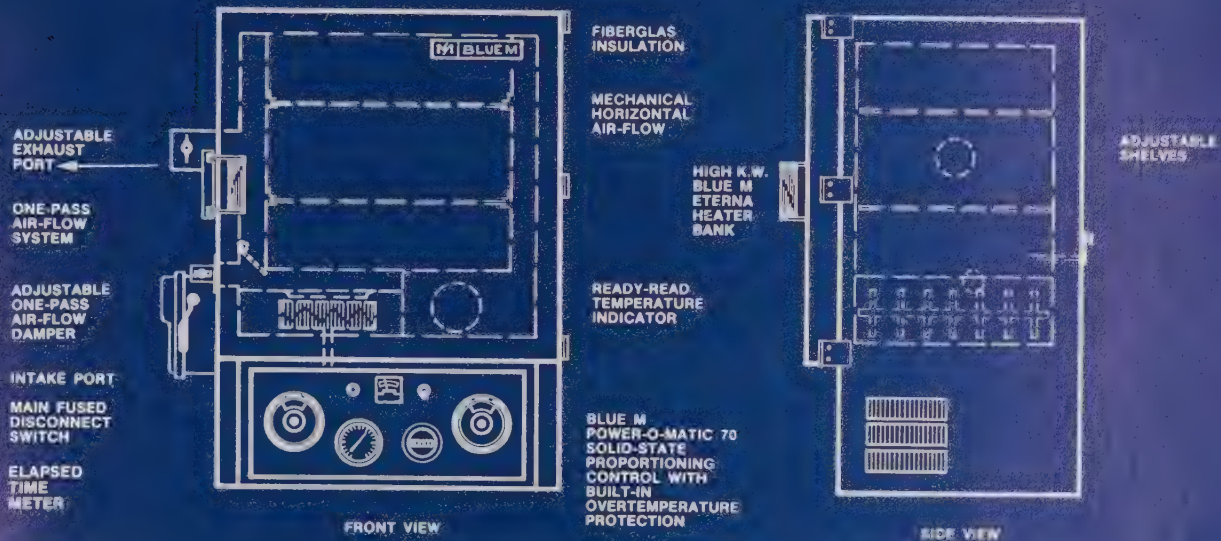
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A BLUE M

STANDARD



AIR CIRCULATION—quality ball bearing motor and balanced multi-bladed blower designed especially for these units.

SHELVES—two wire rod type nickel-plated steel, adjustable to 7 positions.

ADJUSTABLE ONE-PASS AIR-FLOW SYSTEM—tempered air passes over heater and through chamber only once if necessary. Readily adjusted to suit operating requirements. Exhaust capacity varies from 13 CFM at +260°C. to 40 CFM at ambient.

OPERATION

Set control for desired temperature. Air, heated by black heat, "controlled" low-watt density shielded ETERNA elements, propelled mechanically and horizontally across working chamber for uniform heat distribution. Fused control circuit and blower motor are interlocked for overload. Workload and equipment protected. NO RADIANT HEAT.

GENERAL SPECIFICATIONS

Model Number	Inside Dimensions Inches (Cm.)			Overall Dimensions Inches (Cm.)			Total KVA	Voltage 60 Hz. A.C. 1 Phase	Cubic Feet Cap.
	W.	D.	H.	W.	D.	H.			
ESP-400BC-4	19 (48)	15 (38)	18 (45)	32 (80)	24 (61)	37 (93)	4.2 3.2	240V. 208V.	2.8

All wiring complete and enclosed to meet N.E. Code, as amended. U.L. Listed.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: TIMERS, INTERIOR LAMP, FLOOR STAND, LEAD-IN PORTS, GLASS OBSERVATION PANEL, AND EXTRA SHELVES.



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Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

APPLICATION:

How to reliably life-test resistors and other critical electronic components over prolonged periods to the most exacting specifications.

OPERATING AND CONTROL CHARACTERISTICS

TEMPERATURE RANGE

5°C. above ambient to +204°C.
(+400°F.)

RUN-UP TIME (No Load)

To +204°C.: 90 minutes.

CONTROL ACCURACY: $\pm 0.5^\circ\text{C}$.

SETABILITY: $\pm 1.0^\circ\text{C}$.

REPEATABILITY: $\pm 0.5^\circ\text{C}$.

BLUE M CERTIFICATION

All tests conducted with no load, no exhaust, and stabilized chamber under normal conditions of voltage and ambients. When unusual line voltages, ambients, severe loads and exhaust rates exist, please contact local sales offices or factory for recommendations.

BLUE M GUARANTEE

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operating requirements.

SOLUTION:

BLUE M 1000-HOUR STILL AIR LIFE-TEST BATCH OVENS

with **POWER-O-MATIC 60**® Saturable Reactor Proportioning Control System.

Batch testing of resistors and similar components under load to critical reliability standards over extended periods becomes a practical reality with these Blue M units. Special black anodized aluminum trays fitted into a heavy Marinite insulating panel at the front of the oven enable life-testing of small components in still air to be conducted in volume. Trays as shown or built to customer specifications.

Typically, an oven with chamber dimensions of 36" W. x 24" D. x 48" H. (24 cu. ft.) can accommodate 50 trays, 10 parts per tray, with a 500-watt dissipation. This 500-unit capacity is proportionately larger or smaller depending on tray design.

The patented POWER-O-MATIC 60 Control, engineered for 10 to 20 years life under normal operating conditions, enables 1000-hour tests to be begun with full confidence that they will be completed successfully. These mechanical convection, horizontal air-flow ovens are also equipped with Blue M's MAX-SET time-delay overtemperature protection, a positive safeguard against operational malfunctions of any kind.

GENERAL SPECIFICATIONS

CONTROL SYSTEM

POWER-O-MATIC 60 Saturable Reactor Proportioning Control System.

MEMORY RING® Temperature Calibrating Dial.

DIAL POINTER LOCK

MAX-SET™ OVERTEMPERATURE PROTECTION

READY-READ TEMPERATURE INDICATOR—3½" diameter. Stainless sensing bulb. Dual scale in C. and F.

ELAPSED TIME METER

VOLTMETER

PILOT LIGHTS

CONSTRUCTION

HOUSING—all-welded #14 and #16 gauge cold rolled steel, reinforced.

WALLS—triple side walls. Side walls removable.

INTERIOR FINISH—aluminum paint.
(Stainless optional.)

EXTERIOR FINISH—attractive blue enamel.
(Stainless optional.)

INSULATION—Fiberglas.

ETERNA HEATER BANKS—cylindrical type, assure years of service.

AIR CIRCULATION—quality ball bearing motor and balanced multi-bladed blower designed especially for these units. Front mounted air damper regulator.

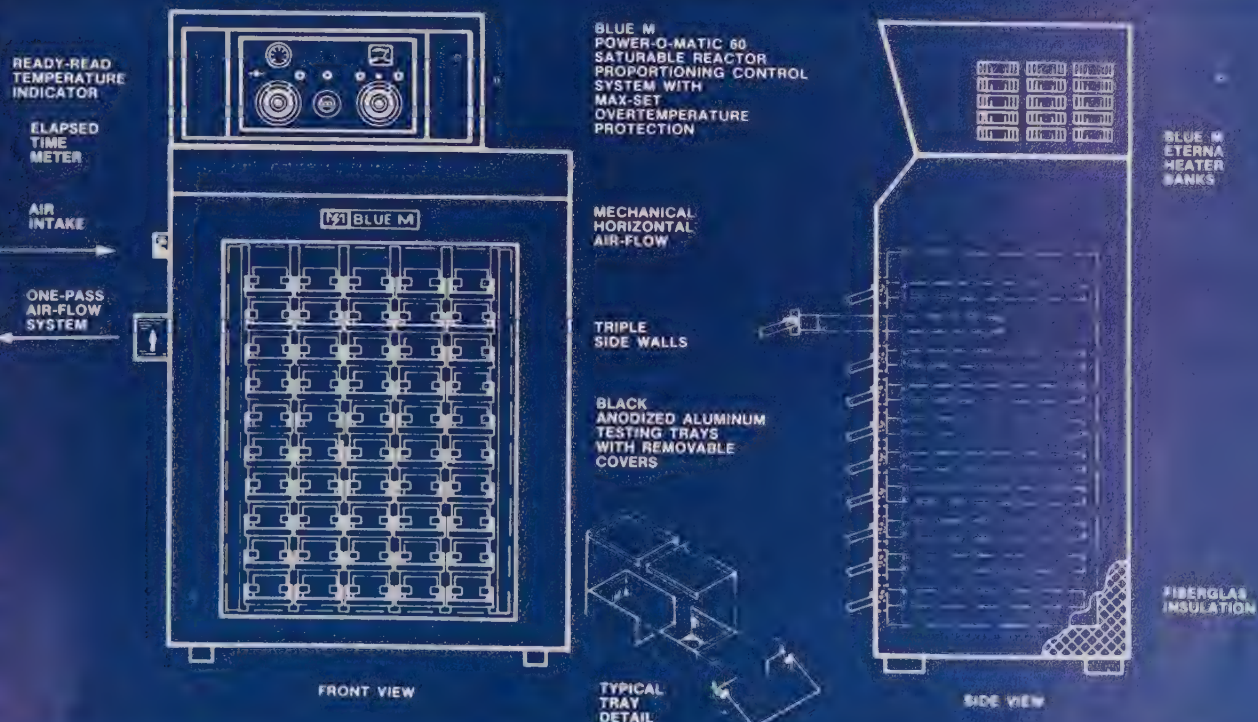
TESTING TRAYS (TYPICAL)—black heavy gauge anodized aluminum with removable covers, size and number determined by chamber dimensions. Fit into 1½" thick Marinite panel behind oven door. Metal

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channels hold strike pins for tray latches. Each tray has silicone rubber seal. Tray size: 3½" W. x 2" H. x 22½" D. typically, but designed to fit individual application.

ADJUSTABLE ONE-PASS AIR-FLOW SYSTEM—tempered air passes over heaters and through chamber only once if necessary. Permits approximate 100% exhaust. Higher K.W. rating may be required for maximum temperature if high exhaust rate is needed.

OPERATION

Set control for desired temperature. Air, heated by black heat, "controlled" low-watt density shielded ETERNA elements, propelled mechanically and horizontally across working chamber for uniform heat distribution. Air changed approximately 50 times per minute. Air velocity through work space is approximately 250 F.P.M. NO RADIANT HEAT.

GENERAL SPECIFICATIONS

Model Number	Inside Dimensions Inches (Cm.)			Overall Dimensions Inches (Cm.)			Total KVA	Voltage 60 Hz. A.C. 3 Phase	Cubic Feet Cap.
	W.	D.	H.	W.	D.	H.			
POM-1016LTTF	19 (48)	20 (51)	39 (98)	37 (93)	34 (86)	75 (190)	9.2	240V	10.0
POM-1630LTTF	24 (61)	24 (61)	48 (120)	44 (111)	37 (93)	83 (211)	10.0	240V	16.0
POM-2450LTTF	36 (90)	24 (61)	48 (120)	56 (142)	37 (93)	83 (211)	10.0	240V	24.0
POM-3270LTTF	48 (120)	24 (61)	48 (120)	68 (172)	37 (93)	83 (211)	10.0	240V	32.0

Other voltages available all models: 208 and 480V./3 Ph.

All wiring complete and enclosed to meet N.E. Code, as amended.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: RECORDERS, CASTERS, AIR-FLOW SWITCH, AND EXTRA TESTING TRAYS.

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**BLUE M**engineered
products in**ACTION****APPLICATION:**

How to perform a wide range of critical LIFE-TESTS with time-temperature schedules requiring programming and recording with accuracy, uniformity and ultra-reliability.

OPERATING AND CONTROL CHARACTERISTICS**TEMPERATURE RANGES**

5° C. above ambient to +204° C.
(+400° F.)

5° C. above ambient to +343° C.
(+650° F.)

RUN-UP TIME (No Load)

To +204° C.: 50 minutes

To +343° C.: 60 minutes

RECOVERY TIME (No Load)

(+204° C. Model)

At +125° C., door open 15 seconds:
5 minutes

(+343° C. Model)

At +250° C., door open 15 seconds:
10 minutes

CONTROL ACCURACY: $\pm 0.5^{\circ}\text{C}$.

SETABILITY: $\pm 1.0^{\circ}\text{C}$.

REPEATABILITY: $\pm 0.5^{\circ}\text{C}$.

TYPICAL AIR TEMPERATURE UNIFORMITY

At +100° C.: $\pm 1.0^{\circ}\text{C}$.

BLUE M CERTIFICATION

All tests conducted with no load, no exhaust, and stabilized chamber under normal conditions of voltage and ambient. When unusual line voltages, ambients, severe loads and exhaust rates exist, please contact local sales offices or factory for recommendations.

BLUE M GUARANTEE

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operating requirements.

SOLUTION:**BLUE M MECHANICAL CONVECTION, HORIZONTAL AIR-FLOW OVENS**

with **POWER-O-MATIC 60** PATENTED Saturable Reactor Programmer-Controller and Separate Monitoring Recorder.

These Blue M Ovens put all the advantages of the exclusive POWER-O-MATIC 60 Saturable Reactor Proportioning Control to work in programming critical life-test procedures in accordance with specific time-temperature requirements. This cam-type, non-cycling system successfully avoids the temperature fluctuations and operator attention inherent in conventional on-off programmers, yet is competitively priced with them. Accuracy of oven temperature at any time during the cycle is dependent only on cam cutting accuracy. This, combined into a quality cabinet, makes these Blue M Ovens ideal for life-testing of all types of the latest electronic and electrical components produced by the semiconductor industry . . . transistors, diodes, capacitors, rectifiers, controlled rectifiers, silicon and germanium micro-components, switches, resistors, etc.

No industry is more aware of the need for ultra-reliable components than the semiconductor industry. These Blue M Ovens, by assuring that the extended tests required to meet these high standards can be safely conducted over months and even years without interruption, represent a ready-made solution to even the most severe life-test reliability problem. Over-temperature protection, now standard, safeguards workload equipment. Elapsed time meter shows how many hours unit has operated.

In cases where the programming cycle of time-temperature must be changed to manual steady state temperature only, these units can be provided with a separate POWER-O-MATIC 60 Saturable Reactor Proportioning Control and toggle switch. This and other optional accessories to increase the versatility of these ovens are listed below.

GENERAL SPECIFICATIONS**CONTROL SYSTEM**

POWER-O-MATIC 60 Saturable Reactor Programmer-Controller with separate monitoring recorder.

RECORDER—single pen, temperature range to match oven.

BLANK CAMS (2)

Cams cut to your exact program optionally available.

MAX-SET™ OVERTEMPERATURE PROTECTION**ELAPSED TIME METER****VOLTMETER****MAIN SWITCH****PILOT LIGHT****CONSTRUCTION**

HOUSING—all-welded heavy gauge cold rolled steel, reinforced.

INTERIOR—type 304, 18-8 stainless.

EXTERIOR FINISH—attractive blue enamel (Stainless optional).

INSULATION—Fiberglas.

DOOR—same construction as unit. Silicone rubber seal.

HARDWARE—exclusive adjustable no-slam, cam action latch and chrome-plated hinges.

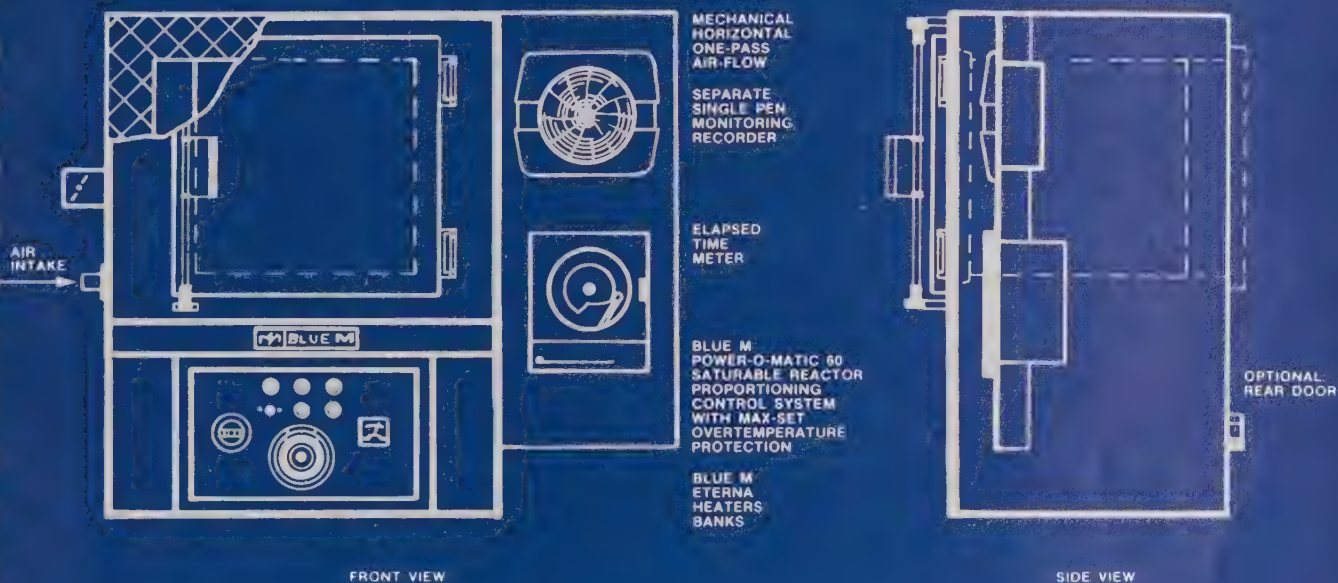
ETERNA HEATER BANKS—cylindrical type, assure years of service.

AIR CIRCULATION—quality ball bearing motor and balanced multi-bladed blower designed especially for these units.

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**BLUE M**



SHELVES—two, wire rod nickel-plated steel, adjustable on 2" centers. (Stainless optional).

ADJUSTABLE ONE-PASS AIR-FLOW SYSTEM—tempered air passes over heaters and through chamber only once if necessary. Permits almost 100% exhaust. Higher K.W. rating may be required for maximum temperature if high exhaust rate is needed.

OPERATION

Turn on cam drive. Air, heated by black heat, "controlled" low-watt density shielded ETERNA elements, propelled mechanically and horizontally across working chamber for uniform heat distribution in accordance with program outlined on the cam. Since Blue M's reactor system is non-cycling, accuracy of temperature control is limited only by the accuracy of the cam, and virtually any desired program is possible. Air changed approximately 50 times per minute. Air velocity through work space approximately 250 F.P.M. NO RADIANT HEAT

Model numbers and typical characteristics shown for +343°C. (+650°F.) range only. Units with range of +204°C. (+400°F.) have similar I.D. and O.D. but total KVA decreases. Write for details.

GENERAL SPECIFICATIONS

Model Number	Inside Dimensions Inches (Cm.)			Overall Dimensions Inches (Cm.)			Total KVA	Voltage 60 Hz. A.C. 1 Phase	Cubic Feet Cap.
	W.	D.	H.	W.	D.	H.			
*POM-146PRC-1	14 (35)	14 (35)	14 (35)	46 (116)	26 (65)	43 (109)	2.8	240V	1.5
*POM-206PRC-1	20 (51)	18 (45)	20 (51)	52 (132)	30 (76)	49 (123)	3.9	240V	4.1
*POM-256PRC-1	25 (63)	20 (51)	20 (51)	57 (144)	32 (80)	49 (123)	5.3	240V	5.8
POM-136PRC-1	38 (95)	20 (51)	25 (63)	70 (177)	32 (80)	62 (157)	9.5	240V	11.0
POM-336PRC-1	25 (63)	20 (51)	38 (95)	57 (144)	32 (80)	75 (190)	9.5	240V	11.0
POM-1406PRC-1	48 (120)	24 (63)	36 (95)	80 (203)	36 (90)	73 (185)	9.8	240V	24.0

*Bench models.

All wiring complete and enclosed to meet N.E. Code, as amended.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: MANUAL POWER-O-MATIC 60 REACTOR CONTROL AND TOGGLE SWITCH, LEAD-IN PORTS, SLOTS, GLASS OBSERVATION PANELS, PYROMETERS, RECORDERS, THERMOMETERS, SHELVES, TIMERS, REAR ENTRANCE DOORS, EXTRA DOORS, COOLING COILS, CABINET TYPE FLOOR STANDS AND CASTERS

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A HARD LOOK AT WATTAGE DISSIPATION APPLICATIONS

By J. A. Lawler
Executive Vice President
Blue M Electric Company

If you are processing parts or components under load and they are dissipating large amounts of heat, you might have. Especially if you're using an older, relatively unsophisticated chamber. In fact, if that description fits your operation at all, you have a bomb, it has a very short fuse—and it's lighted!

Blue M is not a burn-in specialist. We leave that highly technical field in the hands of others. But as a leading designer and manufacturer of electric ovens, we are certainly on the periphery of the field: our chambers are often specified by fixturing houses engaged in supplying such facilities. Our stance precludes taking any responsibility for what might turn into a disaster. In fact, our position is analogous to that of a manufacturer of a boat off of which someone falls and drowns. Or of a car which someone drives into a tree. We are—at most—indirectly involved. Yet our experience and knowledge as a chamber manufacturer enables us to spot certain danger signals, weigh their severity, and even anticipate the probability of a disaster, judge the time of the disaster and gauge its magnitude.

Our ringside seat in the wattage dissipation arena, then, has allowed us to see enough problem situations to be able to practically categorize them. And certainly one of the most common is the old-chamber-doing-more-than-it-was-designed-to-do mentioned earlier.

Often, a company will begin burn-in work in a very small way. Often, too, such a modest program is conducted in one or more existing chambers. Chances are, these are relatively simple, relatively old ovens that have been used successfully for relatively non-critical heating applications for years. And chances are they are not equipped with even the most rudimentary safety devices mandatory in burn-in work.

Nevertheless, they are pressed into burn-in service, and actually—depending on the load being processed—they might very well do an acceptable job. It is by sheer luck, of course, that they don't burn up but we suspect that many companies are using old equipment for such work through ignorance, and are getting away with it.

The point is . . . how long will their luck last?

There is a tendency always to try to do more and more with the same facilities. Very probably products dissipating more and more heat will be pushed through the old equipment as time passes—not through willful neglect, as we say, but through ignorance. The we-went-this-far-before-why-not-go-a-little-further-now principle. Sooner or later, though, enough heat will be generated inside the old unit for it and its contents to ignite and be totally destroyed. It is only a matter of time.

DO YOU
HAVE A
**BOMB**
IN YOUR
TEST
LAB?

While such situations are common, there are several others that are different but the end result is the same. For example, a standard oven is used. It overheats. Its overtemperature protection system is activated and shuts down the unit—including the airflow system. The load inside continues to generate heat within a confined, closed area. Destruction of the chamber and the workload is inevitable.

Take another example. Chamber and workload are undergoing an overnight run. The watchman thinks he detects something wrong. Just to be sure, he shuts off the chamber's main circuit breaker. The effect, of course, is the same as with the tripped OTP: the unit shuts down, but the load inside continues to generate heat. Disaster is right down the road.

A final example. Chamber and workload are operating. For some reason, the chamber's electrical circuit blows, but the circuit for the workload does not. As in our previous examples, uncontrolled heat is generated inside a closed area with disaster lying just ahead.

Obviously, the conditions outlined in these examples would cause disasters in new chambers as well as old. In fact, they might well have a better chance of happening sooner in a new chamber simply because the user would have greater faith in it and might take more chances with it. Like processing a larger load, for example, right from the start.

While we are not burn-in specialists, our experience as chamber manufacturers suggests a number of design criteria which are essential in units for such service. In view of what has been already said, the following will be seen to be only logical suggestions.

The chamber must have maximum exhaust capabilities. It is essential that an adequate means to remove excessive heat be built in. We recommend the installation of a large one-pass airflow system. Such an arrangement enables external air to enter the chamber and pass through it only once before being exhausted. This minimizes the chance for heat build-up inside.

Another must safety feature is an interlock relay. Should the chamber malfunction for any reason, this device automatically shuts down the chamber and cuts off the power to the workload. The necessity and advantage of this are obvious.

Naturally, the chamber must be equipped with an effective overtemperature protection system. But for wattage dissipation applications, the OTP must do more than just shut down the chamber as our earlier examples have shown. The OTP must also activate the interlock relay to shut off power to the workload and it should also be wired so

that it allows the blower to keep operating. This will exhaust any residual heat which may harm the workload.

In addition, we recommend the installation of an airflow switch. This shuts down the unit any time the normal airflow through the chamber is stopped or drastically reduced.

Finally, the temperature sensor must be properly placed on the downstream side of the airflow. This location enables it to detect variations in temperature quickly and accurately, and to trip the chamber's various protective devices before damage can be done.

We recommend still another safety precaution which is not an integral part of the chamber. When very high voltages are involved in the application—and they often are—one faulty connection, one defective fixture can cause an arc . . . a fire. Very little can be done in such circumstances, since the workload will probably be severely damaged or destroyed almost at once. This can only be avoided by installing an in-house CO₂ sprinkler system to snuff out the fire immediately.

No doubt these precautions will seem outlandish to our friends relying on luck and old chambers. And they will continue to seem outlandish until the former runs out and the latter burn up. But are they?

We think not. Especially when you remember that the chamber represents only a small fraction of the total value of the burn-in facility. It is not uncommon for a chamber costing less than \$10,000 to be handling wattage dissipation applications where \$250,000 worth of workload and fixtures are involved.

Aren't the safeguards we recommend worth a few hundred extra dollars to protect such an investment? We think so.

And isn't doing anything less irresponsibly foolish? We know so.

But admittedly we don't have all the answers. As we said earlier, we at Blue M are not burn-in specialists. We are chamber manufacturers. Period.

We are willing to listen—and learn. We're eager to study any suggestions those with burn-in applications may have. And to work with them. By working together we may well be able to develop equipment and methods that will remove all doubt and worry . . . all danger of loss . . . in these critical applications. Time and effort spent now is much more constructive, much less expensive than legal battles later on.

There is no need for a bomb in your lab.

SEND FOR ADDITIONAL INFORMATION AND ALL PRICES

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BLUE M INERT GAS OVENS, MANUAL OR PROGRAMMED

The Most Advanced Units Ever Developed

For Critical Processing In An oxygen-Free Environment

In recent years, the need for a reliable, practical, economical means to process components at elevated temperatures in an oxygen-free environment has grown rapidly and steadily. To fulfill this need, Blue M has engineered a special group of ovens that ideally suit most inert gas applications in existence today. These units are described in detail on the following pages and are available for manual or automatic operation in a variety of capacities and temperature ranges.

However, before reading about them, we recommend reviewing the following comments on inert gas processing. Our information deals primarily with the smaller batch type operation at various temperatures of +316°C., and +593°C. (or lower). Applications of this type are among the most common, yet little technical data has been published to assist the potential user. We are confident this data will help fill this need.

TYPICAL APPLICATIONS

Since these comments are confined primarily to processing within an ambient to approximately 1000°F. range, what kind of heat-treating work is conducted at these temperatures? There are many: soldering, brazing, silver soldering, curing of epoxies, plastics, elastomers, paints, varnishes, adhesives, bonding materials, stress relieving alloys, annealing low-temp alloys, hardening alloys (particularly precipitation hardening types), life-testing, applying decals, low temperature sintering, baking out etch or photo resists.

While the prime value of inert gas processing is the prevention of material oxidation during such operations as these, there are other reasons for desiring oxide-free parts, and other applications for inert atmosphere equipment. Some important ones are described below. Involvement with any one of them could well justify the purchase of suitable inert gas processing equipment.

1) To preserve the appearance of the part or device without costly post-processing cleaning or brightening. Particularly valuable when processing large quantities of small irregularly shaped parts; machined, stamped, etc.

2) To preserve the integrity of a device or part requiring further processing after heat treatment. Problems with adhesion of plating and painting materials can be reduced with oxide-free surfaces. Similarly, strong fluxes can be replaced with weak, less corrosive materials if oxidation is prevented before soldering.

3) Many metal-to-metal, metal-to-plastic or metal-to-glass components require bonding at elevated temperatures. However, if the metal oxidizes before the bonding temperature is reached, the bond may be ineffective or incomplete. Inert atmosphere processing is essential for quality results.

4) Drying or moisture removal in a nitrogen atmosphere is advantageous since dry nitrogen has an affinity for moisture. An atmosphere with a dewpoint of -50°F. or -75°F. has a much greater capacity to absorb moisture than room air with a dewpoint of +40°F. or +50°F. Therefore, the drying process time can be substantially reduced. This is doubly beneficial for electronic component processing, since oxide-free parts are produced making subsequent soldering operations trouble free.

5) Oxidation prevention in a clean room is an indirect benefit, since pure dry nitrogen gas is used to preserve a positive pressure while preventing the infiltration of minute particles into the heated chamber. This minimizes contamination. Important in processing or testing integrated circuits and other solid-state devices, this is required before chips of silicon or germanium are encapsulated.

6) The inert atmosphere either promotes or prevents a chemical reaction which provides desired qualities in the finished part. For example, filled FEP and TFE resins must be shaped and then sintered before they form a tough homogeneous mass. These materials, if sintered under inert atmosphere, are tougher and stronger than when processed in air. When sintering temperature is above oxidation temperature of the filler materials, an improved bond is formed with the nonoxidized materials. When TFE resins are mixed with nonferrous powdered metals no discoloration occurs eliminating any machine operations.

INERT GASES

Any gas chemically inert at the maximum temperature of the process can be used as a protective atmosphere. Helium, Neon, Argon, Krypton and Xenon are truly inert, forming no known chemical compounds except at plasma temperatures. Unfortunately, all except Argon and Helium are too rare and costly for inert atmosphere use at this time.

Argon is used when heat treating iron alloys, particularly stainless steels of the precipitation hardening types and those subject to nitriding. Helium with even greater cost is used only rarely when improved properties can justify the expense.

However, there are two, low-cost gases which can be considered inert for most applications: nitrogen and carbon dioxide.

Carbon dioxide is probably the most inexpensive of the gases, but its use is limited. At temperatures above +700° to +800°F., carbon dioxide can break down to release traceable amounts of oxygen. This overcomes the purpose of the process. Carbon dioxide has been, however, successfully used in heat treating copper alloys, the easiest materials to maintain in a bright condition.

Molecular nitrogen (N₂) is extremely inert to temperatures well in excess of +1000°F. It is abundant in nature, comprising about 80% of the earth's atmosphere, and is relatively easy to produce. It is not surprising, therefore, to find it as the workhorse of inert atmosphere processing.

Nitrogen is used almost exclusively for processing electronic parts to eliminate oxidation and to provide a dust-free atmosphere for clean work. It is used for brazing and heat treating of low temperature alloys, with some restrictions when used with ferric alloys. At temperatures of +950°F. and higher, some ferric alloys will react with nitrogen to form surface nitrides. Sometimes these nitrides are desirable to produce a case hardening. However, in other applications this is undesirable since brittleness can result, and Argon or Helium are substituted.

Oxygen may also be used. Obviously, oxygen cannot be considered an inert gas. It must be handled with extreme caution. However, the basic equipment and procedures used are much the same as a standard inert atmosphere oven.

GAS PURITY

Most gases will contain traces of oxygen and water vapor which can cause poor results. Two cylinders of nitrogen gas can be extremely different. For example, one supplier gave the following analysis of two grades of nitrogen he was supplying:

Grade "Dry Nitrogen"

Dewpoint: -24°F.
Water Content: 338 parts/million
Oxygen Content: 1000 parts/million

Grade "Prepurified Nitrogen"

Dewpoint: -76°F.
Water Content: 10.5 parts/million
Oxygen Content: 10 parts/million

Obviously, the "Prepurified" grade will give much better results than the "Dry" grade. Surprisingly, the added cost of the "Pre-

purified" grade is due to the method of cylinder cleaning and purging before it is refilled and the added cost is insignificant.

(Note: Dewpoint indicates the temperature at which moisture would precipitate from the gas and is a measure of the quantity of water in the gas.)

The traceable amounts of contamination with the higher grade gas could still cause problems which could be eliminated by further refining at a substantial cost increase. Even so, excellent results still could not be guaranteed since the parts might have sight oxides adhering to surface areas. These can break down and form new oxides at elevated temperature. A simple means to overcome this is by adding a trace of hydrogen gas. Hydrogen-nitrogen mixtures are generally called FORMING GAS.

Hydrogen gas is by no stretch of the imagination inert. However, it will not burn or otherwise react with atmospheric oxygen until its concentration builds to 4-5% in air. Forming gas with less than 8% hydrogen mixture will not mix with air to produce a 4% hydrogen mixture. Therefore, these mixtures can be handled with reasonable care. In oxygen-rich atmospheres, hydrogen content must be limited to 3% for safety.

Small amounts of hydrogen can be extremely beneficial since they immediately reduce any traceable oxides formed from contaminated gas, parts, or oven interior. One point: since the small quantity of hydrogen introduced has a very limited capacity, reasonable care must still be exercised to assure acceptable results.

Hydrogen embrittlement is one possible problem associated with most metals, particularly those which contain entrapped oxygen. Hydrogen combines with oxygen to form water vapor under pressure. To relieve this pressure, small surface cracks form and reduce metal ductility.

We obviously cannot treat hydrogen embrittlement properly here beyond mentioning that this condition can be a problem. Copper and copper alloys are particularly sensitive. However, it is almost unknown in austenitic stainless steels. If the parts to be processed do not fall into one or the other of these categories, investigate before a hydrogen-bearing atmosphere is employed.

MATERIAL PREPARATION AND HANDLING

It is obvious that heat treating will not clean dirty parts. The electronics industry has pursued cleanliness to the utmost. Much can be learned from this research and effort.

Simple degreasing may be enough for copper alloys. However, when nickel-iron alloys, stainless steels and similar materials are processed, such techniques as electropolishing, passivation and bright dipping may be required to assure clean surfaces.

One point often overlooked is that mechanical polishing before heat treating reduces the production of clean parts. Microscopic polishing compounds will be embedded deep into the material

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surface. Subsequent processing in an inert atmosphere will produce a variegated color tint when these particles carbonize or otherwise change.

For example, mill finish type 304-2B stainless remains clean when heated in a forming gas atmosphere after simple degreasing. However the same stainless polished to a #3 finish will turn an amber to purple color unless first electropolished.

We recommend materials be handled with clean gloves after cleaning since oily fingerprints may be permanently "embossed" into metal surfaces by heat treating.

Containers for parts must be selected with care. With certain materials, stainless steels are to be avoided. Stainless materials have a tenacious oxide formed on their surface at room temperature. This can and does break down at high temperatures. Materials in contact with the stainless container or shelf will oxidize as temperatures are increased and decreased.

For example: a 50% nickel/50% iron alloy was processed in an Argon atmosphere. The stainless container came out clean, but the piece parts took on a scattered brownish tint. When the parts were processed in Pyrex dishes acceptable results occurred.

SUMMARY

To produce clean work with an inert gas atmosphere, the following must be considered.

- 1) Proper use of the oven to set up and maintain clean atmosphere.
- 2) Use atmosphere compatible with parts being processed.
- 3) Be sure gas is clean with minimal oxygen and water content.
- 4) Be sure parts are properly cleaned before heat treatment.

BASIC TYPES OF INERT ATMOSPHERE CHAMBERS

Technically and realistically the obvious way to eliminate processing problems is to remove the oxygen surrounding the materials being heat treated. No oxygen, no oxidation!

Two basic methods are available:

1) A LEAK-FREE CHAMBER, WITH ALL AIR REMOVED.

While sometimes practical, vacuum heating facilities are extremely bulky, expensive, and complicated. In addition, all heating is accomplished by radiation and conduction—there is no air to convect heat and temperature; uniformity may be excessive. Also, out-gassing or sublimation under high vacuum can be more detrimental to many materials than simple surface oxidation. These problems are partially solved by drawing a vacuum and back-filling the chamber with an inert gas. However, considering equipment cost, a much less expensive means to achieve the same result is the inert atmosphere oven.

2) THE INERT ATMOSPHERE OVEN

A WELL-SEALED AND INSULATED, ELECTRICALLY HEATED STAINLESS STEEL CHAMBER WITH THE RATE OF LEAKAGE BEING IMPORTANT SINCE IT MAKES POSSIBLE THE INITIAL PURGE AND DETERMINES GAS USAGE DURING OPERATION. Mechanical horizontal convection for proper mixing of the atmosphere to avoid stratification and to provide good temperature uniformity is necessary. Other recommended features include a means of cooling the sealed chamber rapidly without loss of gas atmosphere. Gas control equipment consisting of such items as gas flow meters, internal pressure gauge and pressure relief valve are required. Blue M meets these requirements.

OPERATION OF THE INERT ATMOSPHERE OVEN

Proper operation is essential with three basic steps required for successful results: (a) Initial purge of oven atmosphere, (b) Maintaining atmosphere during runup to temperature and through the dwell period, (c) Maintaining atmosphere to proper unloading temperature.

INITIAL PURGE

When workload is placed into the chamber, oxygen-laden ambient air surrounds the parts. The purge cycle forces air out of the unit and replaces it with the desired gas atmosphere. This is accomplished by dilution and must be completed before the work load reaches oxidation temperature. Purge should be completed before oven heat is turned on.

As a general rule, a good purge cycle requires a flow of gas through the unit equal to the entire enclosed volume of the chamber in cubic feet multiplied by a factor of 5, 10, or 15 times depending on the parts being processed.

While the gas flow rate is not important during purge, the total volume is. For example, a 5 cubic foot chamber requires 50 cubic feet of purge gas. This could mean a flow rate of 20 cubic feet/hour for 2½ hours or a more practical purge of 100 cubic feet/hour for 1/2 hour. The results would be the same. One important point: if the oven is designed for a very slight leakage rate, a flow of 100 cubic feet/hour might cause high interior pressure and a relief valve is essential. DO NOT purge the unit with heat on. With a high performance oven, it is possible for part of the air gas stream to reach oxidation temperature before the dilution process is completed.

MAINTAINING ATMOSPHERE DURING RUNUP AND DWELL

The purge cycle provides a volume of clean inert atmosphere. This must now be maintained with a sufficient gas flow to overcome leakage and hold a slight positive pressure to assure a slight flow of atmosphere out through any leakage points and prevent migration of air into the chamber. A pressure of 1 to 2

ounces per square inch (2 to 3 inches of water column) is adequate. However, 1/4 PSI is far more reassuring if the work load is hypersensitive and costly.

If a pressure gauge is not available, the total chamber volume multiplied by a factor of 5 will give a flow rate per hour that will hold a positive pressure in a properly designed chamber. However, a pressure gauge is recommended to indicate condition of door and other seals.

MAINTAINING ATMOSPHERE TO PROPER UNLOADING TEMPERATURE

Especially important is maintaining the gas atmosphere during cool-down cycle. Gas flow rate must provide a constant positive internal pressure to prevent migration of air into chamber until the product has dropped below its oxidation temperature. Safe unloading of materials can generally take place at +125°C. or less depending on type of product and the reason for inert gas processing. When in doubt, a simple test of the material heated in air will indicate what temperatures can be tolerated.

Another point to keep in mind is the temperature indicating device on most units indicates atmosphere temperature. Product temperature, particularly when a large mass is involved, however, can be substantially higher on cool-down cycle.

BLUE M INERT GAS OVENS

The Blue M Inert Gas Ovens described on the following pages are easily the most advanced units of their kind available today. Representing a unique blend of engineering skill, experience, and proven design concepts, these chambers meet the most exacting demands of present-day inert gas processing technology. A review of their many outstanding design and performance characteristics will quickly reveal they fulfill the requirements we have mentioned previously.

These ovens are presented here in a logical sequence to help in determining the proper selection for your particular application. The first series on pages 128 and 129 are the basic units upon which a sound inert gas processing program can be built. They have a relatively limited temperature range from +100°C. to +316°C. and are equipped with a manual gas control system. These units are suitable for applications where operation near ambient and rapid cool-down are not essential. Also, because of their manual gas control system, operator attendance and a degree of operational skill are required to assure their proper use. At the same time, however, they do provide a safe, reliable means to process in an inert atmosphere with a minimum capital investment.

The units on pages 130 and 131 are similar to these, except they have a more flexible operating range of ambient to +316°C., a faster cool-down rate, and also feature automatic purging. The fully automatic initial purge of the chamber eliminates the need

for operator training while operator attendance can be minimized. The use of a built-in stainless steel tap water cooling coil, an essential feature for maximum operating efficiency, permits rapid cool-down and lower minimum operating range. A number of options—including programming for fully automatic operation—extend the flexibility of these ovens even more for the most exotic applications.

The Blue M Ultra-Temp Inert Gas Ovens on pages 132 and 133 meet the demands for high temperature operation. They are equipped with Blue M's patented POWER-O-MATIC 80 Solid-State SCR Proportioning Control System and offer a range to +593°C. They have an efficient manual gas control system and a forced air cooling system for rapid cool-down and operation below +175°C. It should be noted that this latter feature is essential in ovens with this high temperature range.

The Ultra-Temp Inert Gas Ovens on pages 134 and 135 are unquestionably our most sophisticated units for high temperature inert gas processing. Full programming automates heat-up and dwell time at operating temperature, regulates initial purging, maintains proper gas atmosphere, and operates the cooling system for rapid post-processing cool-down. Equipped with the POWER-O-MATIC 80 Control System, these fine ovens are recommended for any critical high temperature inert gas application requiring the ultimate in performance and operational ease.

The last units in this section, the Nitrogen Dry Box Bake Out Ovens on pages 136 and 137, are similar to the first except that they are equipped with a special rear door making them suitable for operation with a dry box unit.

Besides offering the testing/processing community a wide choice of inert gas ovens to fit the broadest scope of applications, Blue M has incorporated into each series all the features essential to proper and efficient inert atmosphere operation. For example, all are equipped with pressure relief valves and pressure gauges to avoid possible built-up of internal pressure during operation. All are safeguarded by time-delay MAX-SET overtemperature protection. Every unit is subjected to positive pressure tests with inert gas at various temperatures before shipment. Interiors are given a special thorough cleaning, shelves electropolished, etc.

Our capability also includes the design and production of large volume inert gas batch ovens. These units are not detailed in this catalog, but are available on special order with the same outstanding features as the ovens in this section and a variety of work chamber volumes to 96 cubic feet maximum. If you have need for a superior high production inert gas oven in a larger-than-normal size, we suggest that you contact us with an outline of your requirements. Your inquiry will receive our prompt attention.

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**BLUE M**engineered
products in**ACTION****OPERATING AND CONTROL
CHARACTERISTICS****TEMPERATURE RANGE**

+100°C. to +316°C. (+600°F.)

RUN-UP TIME (No Load)

60 minutes or less

COOL-DOWN (No Load)

Maximum to +125°C. (+257°F.):

4½ hours

CONTROL ACCURACY: ±0.5°C.**SETABILITY:** ±1.0°C.**REPEATABILITY:** ±0.5°C.**TYPICAL AIR TEMPERATURE
UNIFORMITY**

At +150°C.: ±1.5°C.

At +300°C.: ±3.0°C.

BLUE M CERTIFICATION

All tests conducted with no load and stabilized chamber under normal conditions of voltage and ambient. When unusual line voltages, ambients, and severe loads exist, please contact local sales offices or factory for recommendations.

BLUE M GUARANTEE

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operating requirements.

APPLICATION:

How to conduct such procedures as heat-treating and baking of parts, materials or components in a non-oxidizing atmosphere where near-ambient operation and rapid cool-down are not essential.

SOLUTION:**BLUE M INERT GAS OVENS**

with **POWER-O-MATIC 60**® Saturable Reactor Proportioning Control and Manual Gas Control System.

These new Blue M units may be considered to be the basic building blocks from which a sound, reliable inert gas processing program can be built. In design, construction, and performance these quality ovens are suitable for any operation requiring processing in an inert atmosphere. They are designed for use with any of these non-flammable gases: Nitrogen, Argon, Helium and Carbon-Dioxide, and with non-flammable mixtures of forming gas—Nitrogen with maximum 8% Hydrogen. They may also be used with a pure Oxygen atmosphere under certain, Blue M-approved, conditions.

Noteworthy features of these ovens include a heli-arc welded gas-tight stainless interior; cam action latches to hold door firmly against silicone sponge rubber seal; sealed element terminals and motor shaft help minimize gas consumption; electropolished blower wheel and shaft. POWER-O-MATIC 60 Control assures excellent performance within very close tolerances. Oven and workload are safeguarded by independent, MAX-SET overtemperature protection.

Efficient manual gas control system consists of a gas flow meter with a metering valve. A pressure relief valve and a 0-3 PSI pressure gauge avoids possible build-up of internal pressure. All units undergo a positive pressure test with inert gas at various temperatures before shipment. Typical bench model is illustrated here, similar floor model is illustrated on next page.

Similar units with tap water cooling coil for rapid cooling rates and lower operating range plus automatic purging to reduce operator attendance are described on the following pages.

GENERAL SPECIFICATIONS**CONTROL SYSTEM**

POWER-O-MATIC 60 Saturable Reactor Proportioning Control System.

MEMORY RING® Temperature Calibrating Dial.

DIAL POINTER LOCK**MAX-SET™ OVERTEMPERATURE PROTECTION**

READY-READ TEMPERATURE INDICATOR—3½" diameter. Stainless sensing bulb. Dual scale in C. and F.

VOLTMETER**PILOT LIGHTS****GAS CONTROL SYSTEM**

Manually operated gas flow meter with metering valve connected to ½" gas supply inlet on side of unit. Pressure relief valve and 0-3 PSI pressure gauge eliminates possibility of gas pressure build-up inside chamber.

CONSTRUCTION

HOUSING—all-welded heavy gauge steel, reinforced.

INTERIOR—heavy gauge, type 304, 18-8, stainless. All seams welded gas-tight and passivated.

EXTERIOR FINISH—baked-on attractive blue enamel.

INSULATION—Fiberglas, 4" minimum.

DOOR—double wall construction, same as unit. Silicone sponge rubber seal.

HARDWARE—two double cam action latches, except small model which has one, to assure positive seal. Chrome-plated latches and hinges.

ETERNA HEATER BANKS—cylindrical type, assure years of service. Terminals effectively sealed to prevent gas loss.

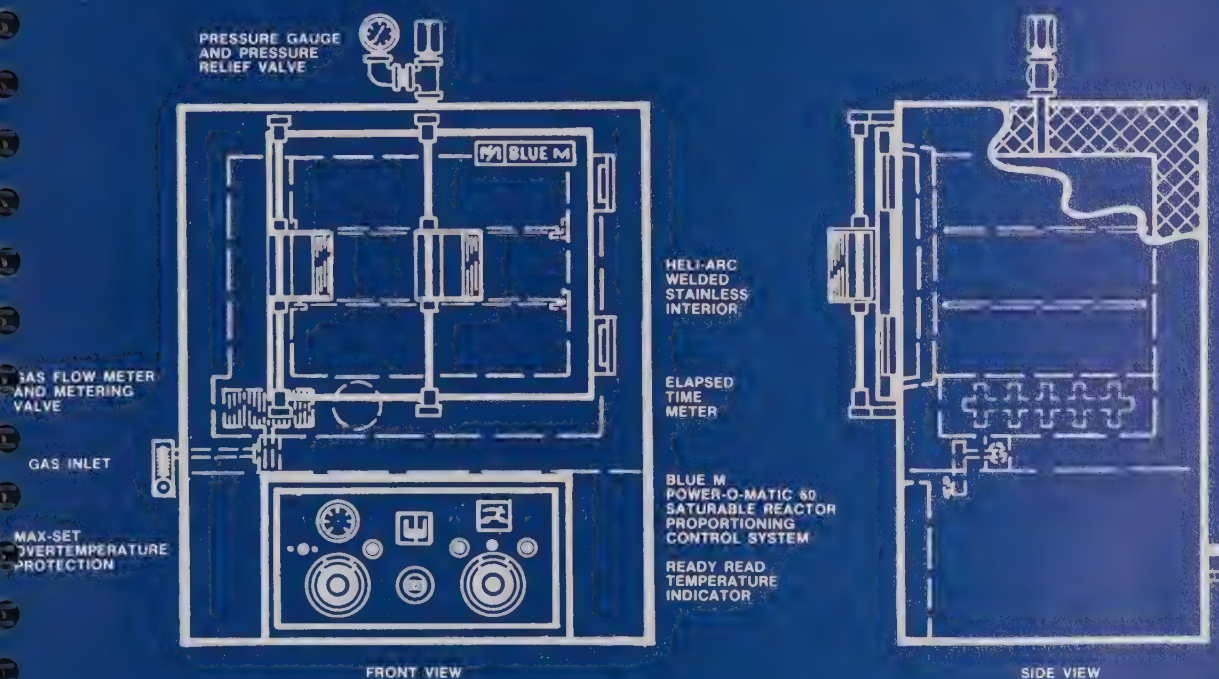
ATMOSPHERE CIRCULATION—quality oversized ball bearing motor with electropolished stainless blower wheel and shaft. Special high temperature shaft seal helps minimize gas loss and use.

SHELVES—two, electropolished stainless rod type or

EQUIPMENT COVERED BY
OUR
EXCLUSIVE

PARTS
WARRANTY
and
REPLACEMENT
SERVICE
PROGRAM

**BLUE M**



expanded metal with tubular frame, depending on model. Adjustable on 2" centers. Shelf brackets supplied.

OPERATION

Introduce inert gas into chamber by means of metering valve on gas flow meter. Set control for desired temperature. Inert gas, heated by black heat, "controlled" low-watt density shielded ETERNA elements, propelled mechanically and horizontally across working chamber for uniform heat distribution. Atmosphere velocity through work space is approximately 250 F.P.M. NO RADIANT HEAT.

APPROX. GAS FLOW RATES

MODEL	PURGE	RUN
IGF-146	100 SCFH for 11 min.	20 SCFH
IGF-206	100 SCFH for 27 min.	25 SCFH
IGF-256	200 SCFH for 18 min.	30 SCFH
IGF-136	200 SCFH for 30 min.	60 SCFH
IGF-336	200 SCFH for 30 min.	60 SCFH
IGF-1406	600 SCFH for 25 min.	120 SCFH

GENERAL SPECIFICATIONS

Model Number	Inside Dimensions Inches (Cm.)			Overall Dimensions Inches (Cm.)			Total KVA	*Voltage 60Hz. A.C. 3 Phase	Cubic Feet Cap.
	W.	D.	H.	W.	D.	H.			
IGF-146F-3 (Bench Model)	14 (35)	14 (35)	14 (35)	32 (80)	29 (73)	51 (128)	2.8	240 V.	1.5
IGF-206F-3 (Bench Model)	20 (51)	18 (45)	20 (51)	38 (95)	33 (84)	57 (144)	3.9	240 V.	4.1
IGF-256F-3 (Bench Model)	25 (63)	20 (51)	20 (51)	43 (109)	35 (88)	57 (144)	5.3	240 V.	5.8
IGF-136F-3 (Floor Model)	38 (95)	20 (51)	25 (63)	56 (142)	33 (84)	70 (177)	9.5	240 V.	11.0
IGF-336F-3 (Floor Model)	25 (63)	20 (51)	38 (95)	43 (109)	33 (84)	83 (211)	9.5	240 V.	11.0
IGF-1406F-3 (Floor Model)	48 (120)	24 (63)	36 (95)	66 (167)	37 (93)	81 (205)	9.5	240 V.	24.0

*Other voltages available for all models: 208 V. and 240 V./1 Ph., and 208 V. and 480 V./3 Ph. Write for details.

All wiring complete and enclosed to meet N.E. Code, as amended.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: TEMPERATURE RECORDERS, CABINET TYPE FLOOR STANDS (FOR BENCH MODELS), CASTERS AND AUTOMATIC SHUT-OFF TIMERS.

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BLUE M EQUIPMENT

A SALES AND SERVICE BRANCH OF
BLUE M EQUIPMENT COMPANY
Corporate Headquarters: Blue Island, Illinois 60406

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California, El Monte 91731
California, Sunnyvale 94086
Florida, Orlando 32789
Georgia, Atlanta 30341

Illinois, Blue Island 60406
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New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

**BLUE M**engineered
products in**ACTION****APPLICATION:**

How to process parts, materials and components in a non-oxidizing atmosphere where production requirements demand rapid cool-down and/or operation under near-ambient conditions.

OPERATING AND CONTROL CHARACTERISTICS**TEMPERATURE RANGE**

Ambient to +316° C. (+600° F.)

RUN-UP TIME (No Load)

60 minutes or less

COOL-DOWN TIME (No Load)

Maximum to +100° C. (+212° F.):

45 minutes or less

CONTROL ACCURACY: $\pm 0.5^{\circ}\text{C}$.**SETABILITY:** $\pm 1.0^{\circ}\text{C}$.**REPEATABILITY:** $\pm 0.5^{\circ}\text{C}$.**TYPICAL AIR TEMPERATURE UNIFORMITY**

At +150° C.: $\pm 1.5^{\circ}\text{C}$.

At +300° C.: $\pm 3.0^{\circ}\text{C}$.

BLUE M CERTIFICATION

All tests conducted with no load, and stabilized chamber under normal conditions of voltage and ambient. When unusual line voltages, ambi-ents, and severe loads exist, please contact local sales offices or factory for recommendations.

BLUE M GUARANTEE

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operating requirements.

SOLUTION:**BLUE M INERT GAS OVENS**

with **POWER-O-MATIC 60**® Saturable Reactor Proportioning Control, Tap Water Cooling Coll, Automatic Purging & MAX-SET Overtemperature Protection.

These new Blue M Ovens are the finest, most sophisticated units in their temperature range available today. Designed specifically for volume processing, they are ideally suited for any inert atmosphere application where rapid cool-down is required, where near-ambient operation is needed, or where a minimum amount of operator supervision is desired. Non-flammable Nitrogen, Argon, Helium and Carbon Dioxide are suitable gaseous media, and the units can also be used with non-flammable mixtures of forming gas—Nitrogen with maximum 8% Hydrogen. A pure Oxygen atmosphere can also be introduced under certain, Blue M-approved, conditions.

Several features make these ovens outstanding: fully automatic initial purge of oven eliminates extensive operator training or operator attendance; all stainless tap water cooling coil cools oven rapidly after processing has been completed and permits oven to be operated at below 100° C.; POWER-O-MATIC 60 Control provides unexcelled straight-line performance throughout range. Independent MAX-SET overtemperature protection safeguards equipment and workload. All units are pressure-tested with inert gas at various operating temperatures before shipment. Typical floor model is illustrated here, similar bench model is illustrated on previous page.

Although these ovens as described are the most advanced of their kind, a number of optional accessories—including unlimited temperature programming for fully automatic operation—extend their operational flexibility even more. This optional equipment is listed below and complete details on it are available from the factory.

GENERAL SPECIFICATIONS**CONTROL SYSTEM**

POWER-O-MATIC 60 Saturable Reactor Proportioning Control System.

MEMORY RING® Temperature Calibrating Dial.

DIAL POINTER LOCK**MAX-SET™ OVERTEMPERATURE PROTECTION**

READY-READ TEMPERATURE INDICATOR— $3\frac{1}{2}$ " diameter. Stainless sensing bulb. Dual scale in C. and F.

VOLTMETER**PILOT LIGHTS****GAS CONTROL SYSTEM**

System which automatically purges chamber of air consists of an oven door switch controlling an adjustable purge timer which regulates a gas flow solenoid valve. Unit also has a 0-3 PSI pressure gauge, gas flow meter and gas metering valves: one to set purge gas flow rate, the other to set

rate during run-up, dwell and cool-down periods. Pressure relief vent eliminates possible gas pressure build-up inside chamber.

COOLING SYSTEM

All stainless finned coil for tap water circulation. Has solenoid valve and panel-mounted on-off switch. Water consumption: 2-5 gals./min. during cool down.

CONSTRUCTION

HOUSING—all-welded heavy gauge steel, reinforced.

INTERIOR—heavy gauge, type 304, 18-8 stainless. All seams welded gas-tight and passivated.

EXTERIOR FINISH—baked-on attractive blue enamel.

INSULATION—Fiberglas, 4" minimum.

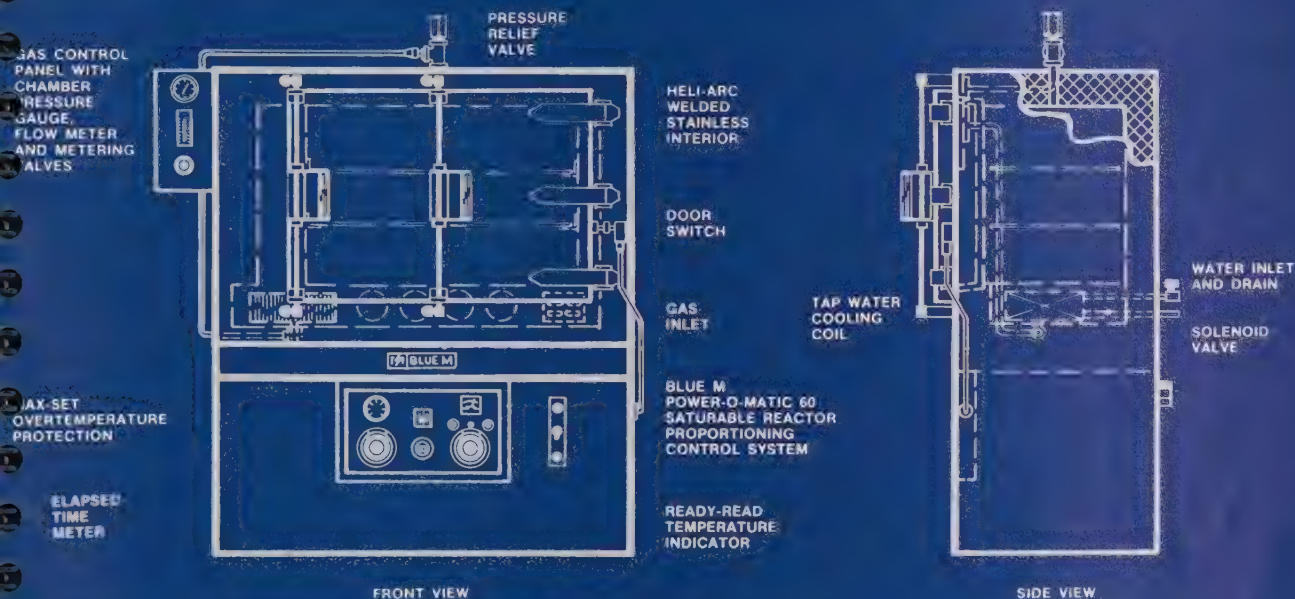
DOOR—double wall construction, same as unit. Sili-cone sponge rubber seal.

HARDWARE—two double cam action latches to assure positive seal. Chrome-plated latches and hinges.

EQUIPMENT COVERED BY**OUR EXCLUSIVE**

PARTS
WARRANTY
and
REPLACEMENT
SERVICE
PROGRAM

**BLUE M**



ETERNA HEATER BANKS—cylindrical type, assure years of service. Terminals effectively sealed to prevent gas loss.

ATMOSPHERE CIRCULATION—quality oversized ball bearing motor with electropolished stainless blower wheel and shaft. Special high temperature shaft seal helps minimize gas loss and use.

SHELVES—two, electropolished stainless rod type or expanded metal with tubular frame, depending on model. Adjustable on 2" centers. Shelf brackets supplied.

OPERATION

Adjust purge timer to desired period. Set control for desired temperature. Closing door activates timer and automatic purging begins. As preset purge period ends, inert gas flow reduces and heat is turned on. Inert gas, heated by black heat, "controlled" low-watt density shielded ETERNA elements, propelled mechanically and horizontally across working chamber for uniform heat distribution. Atmosphere velocity through work space is approximately 250 F.P.M. NO RADIANT HEAT. Manually operated panel-mounted switch activates cooling for rapid chamber chilling if desired.

APPROX. GAS FLOW RATES

MODEL	PURGE	RUN
AGC-206	100 SCFH for 27 min.	25 SCFH
AGC-256	200 SCFH for 18 min.	30 SCFH
AGC-136	200 SCFH for 30 min.	60 SCFH
AGC-336	200 SCFH for 30 min.	60 SCFH
AGC-1406	600 SCFH for 25 min.	120 SCFH

Model Number	Inside Dimensions Inches (Cm.)			Overall Dimensions Inches (Cm.)			Total KVA	*Voltage 60Hz. A.C. 3 Phase	Cubic Feet Cap.
	W.	D.	H.	W.	D.	H.			
AGC-206F-3 (Bench Model)	20 (51)	18 (45)	20 (51)	46 (95)	33 (84)	57 (144)	3.9	240V	4.1
AGC-256F-3 (Bench Model)	25 (63)	20 (51)	20 (51)	51 (109)	35 (88)	57 (144)	5.3	240 V.	5.8
AGC-136F-3 (Floor Model)	38 (95)	20 (51)	25 (63)	64 (142)	33 (84)	70 (177)	9.5	240 V	11.0
AGC-336F-3 (Floor Model)	25 (63)	20 (51)	38 (95)	51 (109)	33 (84)	83 (211)	9.5	240 V	11.0
AGC-1406F-3 (Floor Model)	48 (120)	24 (63)	36 (95)	74 (174)	37 (93)	81 (205)	9.5	240 V	24.0

*Other voltages available for all models: 208 V. and 240 V./1 Ph., and 208 V. and 480 V./3 Ph. All wiring complete and enclosed to meet N.E. Code, as amended.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: FULLY AUTOMATIC OPERATION WITH UNLIMITED TEMPERATURE PROGRAMMING; FULLY AUTOMATIC OPERATION WITH SINGLE POINT TEMPERATURE OPERATION; RESERVE GAS SUPPLY SYSTEM; RECORDERS; CABINET TYPE FLOOR STANDS (FOR BENCH MODELS); CASTERS, AND AUTOMATIC SHUT-OFF TIMERS

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Pennsylvania, Ardmore 19003
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Washington, Seattle 98108

**BLUE M**engineered
products in**ACTION****OPERATING AND CONTROL
CHARACTERISTICS****TEMPERATURE RANGE**

+50°C. to +593°C. (+1100°F.)

RUN-UP TIME (No Load)

60 minutes or less

COOL-DOWN TIME (No Load)

90 minutes—4.1 and 5.8 cu. ft. models

120 minutes—11 and 24 cu. ft. models

ACCURACY: $\pm 0.5^\circ\text{C}$.**COMBINED SETABILITY AND****REPEATABILITY:** $\pm 0.1\%$ of scale**TYPICAL AIR TEMPERATURE
UNIFORMITY**At +300°C.: $\pm 3.0^\circ\text{C}$.**BLUE M CERTIFICATION**

All tests conducted with no load, and stabilized chamber under normal conditions of voltage and ambient. When unusual line voltages, ambients, and severe loads exist, please contact local sales offices or factory for recommendations.

BLUE M GUARANTEE

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operating requirements.

APPLICATION:

How to process critical parts and components at unusually high temperatures in an oxygen-free environment.

SOLUTION:**BLUE M ULTRA-TEMP INERT GAS OVENS**with ~~POWER-O-MATIC 80~~ ^{POWER-O-MATIC 80}™ Solid-State SCR Proportioning Control System

Processing small parts and components to critical requirements at very high temperatures without oxidation can be reliably accomplished in these quality chambers. They are designed for use with any of these non-flammable gases: Nitrogen, Argon, Helium and Carbon Dioxide, and with non-flammable mixtures of forming gas—Nitrogen with maximum 8% Hydrogen.

The patented POWER-O-MATIC 80 Control System provides infinitely proportional, straight-line performance with a maximum temperature capability of +593°C. It can be relied upon for reliability and accuracy to meet the most severe operating standards. MAX-SET overtemperature protection safeguards valuable equipment and workloads.

Additional significant features include an efficient manual gas control system with a pressure release vent to avoid gas pressure build-up inside the chamber and a forced air cooling system for rapid oven cool-down after processing and for oven operation below +175°C. All units are pressure-tested with inert gas at various operating temperatures before shipment.

Similar POWER-O-MATIC 80 equipped units with programming are described on the following pages.

GENERAL SPECIFICATIONS**CONTROL SYSTEM**

POWER-O-MATIC 80 Solid-State SCR Proportioning Control System offers infinitely proportional, true straight-line performance throughout the unit's range. Designed specifically for control of elevated temperatures. Including a 10-turn potentiometer and working in conjunction with Blue M's patented Memory Ring® Temperature Calibrating Dial, POWER-O-MATIC 80 offers an expanded scale length of over 70" for remarkable setability/repeatability. Dual scale in C. and F.

MAX-SET™ OVERTEMPERATURE PROTECTION: Indicating type, dual scale with range to complement main control and installed conveniently adjacent to it. Indication accuracy $\pm 1\%$ of full scale. Provides constant monitoring over entire span; you see what the chamber temperature actually is at all times. Operates independently of control in response to its own thermocouple.

DUAL THERMOCOUPLES: One for control, one for OTP. Break protection: unit shuts down if T/C fails.

POTENTIOMETER—10-turn. Insures extremely fine control setability.

PILOT LIGHTS**GAS CONTROL SYSTEM**

Manually operated, mounted on side of unit, consisting of 0-3 PSI pressure gauge and two gas flow meters with metering valves. One meter and valve measures and controls cooling gas between inner and outer doors. Pressure relief vent and 0-3 PSI pressure gauge eliminates gas pressure build-up inside chamber.

COOLING SYSTEM

Efficient, reliable forced air system.

CONSTRUCTION

HOUSING—all-welded heavy gauge cold rolled steel, reinforced.

INTERIOR—type 304, 18-8 stainless, heli-arc welded gas-tight. All welds passivated.

EXTERIOR FINISH—baked-on attractive blue enamel. Front plate finished in high temperature aluminum paint.

INSULATION—Mono-Block and Fiberglas.

DOOR—double wall, same construction as unit. Sili-cone sponge rubber seal.

HARDWARE—two double cam-action latches to assure positive seal. Heavy-duty latches and hinges.

EQUIPMENT COVERED BY
OUR
EXCLUSIVE

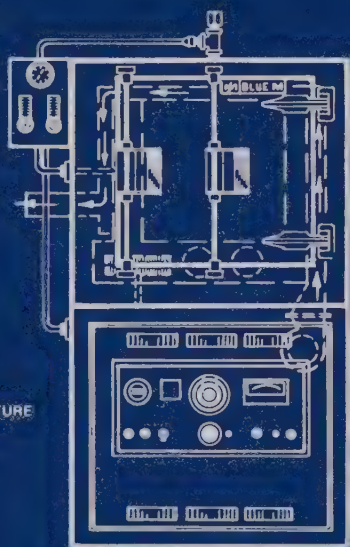
PARTS
WARRANTY
and
REPLACEMENT
SERVICE
PROGRAM

**BLUE M**

GAS CONTROL
PANEL WITH
CHAMBER
PRESSURE
GAUGE AND
FLOW METERS

AIR
EXHAUST

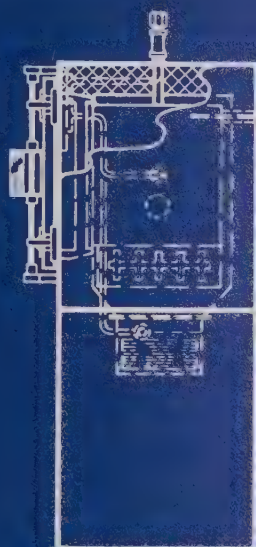
MAX-SET
OVERTEMPERATURE
PROTECTION



FRONT VIEW

BLUE M
POWER-O-MATIC 80
SOLID-STATE SCR
PROPORTIONING
CONTROL SYSTEM

STAINLESS INTERIOR



SIDE VIEW

PRESSURE
RELIEF VENT

GAS INLET

FORCED AIR
COOLING
SYSTEM

INNER DOOR—stainless steel with pivot type alloy hinge. Covers entire chamber opening. Reduces elevated chamber temperature to outer door seal.

ETERNA HEATER BANKS—cylindrical type, assure years of service. Terminals effectively sealed to prevent gas loss.

ATMOSPHERE CIRCULATION—quality oversized ball bearing motor with electro-polished stainless blower wheel and shaft. Special high temperature shaft seal helps minimize gas loss and use.

SHELVES—two, 18-8 electro-polished stainless, adjustable on 2" centers.

MOTOR OVERLOAD PROTECTION—built-in thermal overload protection starter, interlocked with heating element circuit.

OPERATION

Introduce inert gas into chambers by means of metering valves on gas flow meters. Set control for desired temperature. POWER-O-MATIC 80 control circuit regulates voltage to element in oven compartment. Chamber temperature is automatically held to an extremely fine degree of accuracy. When processing is complete, turn off oven and activate forced air cooling system

APPROX. GAS FLOW RATES

MODEL	PURGE	RUN
IGF-6680	100 SCFH for 27 min.	30 SCFH
IGF-7780	200 SCFH for 18 min.	33 SCFH
IGF-8880	200 SCFH for 33 min.	65 SCFH
IGF-9980	600 SCFH for 24 min.	120 SCFH

GENERAL SPECIFICATIONS

Model Number	Inside Dimensions Inches (Cm.)			Overall Dimensions Inches (Cm.)			Total KVA	Voltage 60 Hz. A.C. 3 Phase	Cubic Feet Cap.
	W.	D.	H.	W.	D.	H.			
IGF-6680F	20 (51)	18 (45)	20 (51)	46 (116)	35 (88)	76 (193)	10.0	240 V.	4.1
IGF-7780F	25 (63)	20 (51)	20 (51)	53 (133)	37 (93)	76 (193)	13.0	240 V.	5.8
IGF-8880F	38 (95)	20 (51)	25 (63)	69 (175)	36 (90)	72 (183)	15.0	240 V.	11.0
IGF-9980F	48 (120)	24 (61)	36 (90)	79 (200)	40 (101)	83 (211)	21.1	240 V.	24.0

Other voltages available, all models: 208 V. and 480V./3 Ph./60 Hz. A.C.
All wiring complete and enclosed to meet N.E. Code, as amended.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: TEMPERATURE RECORDERS, CASTERS, AND AUTOMATIC SHUT OFF TIMERS

SEND FOR ADDITIONAL INFORMATION AND ALL PRICES

BLUE M EQUIPMENT

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North Carolina, Charlotte 28210
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Washington, Seattle 98108

**BLUE M**

engineered
products in
ACTION

APPLICATION:

How to process parts and components in an oxygen-free environment at high temperatures where all operations are programmed and fully automatic.

OPERATING AND CONTROL CHARACTERISTICS**TEMPERATURE RANGE**

+50°C. to +593°C. (+1100°F.)

RUN-UP TIME (No Load)

60 minutes or less

COOL-DOWN TIME (No Load)

90 minutes: 4.1 and 5.8 cu. ft. models

120 minutes: 11 and 24 cu. ft. models

CONTROL ACCURACY: $\pm 0.5^{\circ}\text{C}$.**REPEATABILITY:** $\pm 2^{\circ}\text{C}$.**TYPICAL AIR TEMPERATURE UNIFORMITY**

At +300°C.: $\pm 3.0^{\circ}\text{C}$.

BLUE M CERTIFICATION

All tests conducted with no load and stabilized chamber under normal conditions of voltage and ambient. When unusual line voltages, ambients and severe loads exist, please contact local sales offices or factory for recommendations.

BLUE M GUARANTEE

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operating requirements.

SOLUTION:**BLUE M ULTRA-TEMP INERT GAS OVENS**

with **POWER-O-MATIC 80** PATENTED Solid-State SCR Proportioning Control System and Programming

These outstanding Blue M chambers are unquestionably the most advanced units for high temperature inert gas processing available today. Similar in design and construction to the ovens described on the previous pages, these units offer the additional advantage of full programming. This not only automates heat-up and dwell time at operating temperature, but the POWER-O-MATIC 80 Control with programming also regulates initial purging and maintenance of proper gas atmosphere, and operation of cooling system for rapid cool-down. A built-in recorder provides visual records of process temperatures as well as MAX-SET overtemperature protection. All controls and instrumentation are housed in a console instrument cabinet. Units are pressure-tested with inert gas at various operating temperatures before shipment.

These ovens are recommended for any critical high temperature inert gas application where minimal operator attendance is desirable.

GENERAL SPECIFICATIONS**CONTROL SYSTEM**

POWER-O-MATIC 80 Solid-State SCR Proportioning Control with programming and end-of-cycle switch functions. Fully automates heat-up, dwell time, and cool-down of oven.

RECORDER-CONTROLLER—provides permanent record of process temperatures and serves as MAX-SET™ overtemperature protection.

MAIN SWITCH**PILOT LIGHTS****VOLTMETER****GAS CONTROL SYSTEMS**

Door switch starts purge timer. Timer controls gas solenoid and starts programmer after purge, thereby controlling flow rates. Flow meters, metering valves, pressure gauge and pressure relief valve allow proper adjustment of systems for fully automatic operation.

COOLING SYSTEM

Efficient, reliable forced air system, controlled automatically by programmer.

CONSOLE INSTRUMENT CABINET—Heavy gauge cold rolled steel, houses all controls and instrumentation. Finish matches unit.

CONSTRUCTION

HOUSING—all-welded heavy gauge cold rolled steel, reinforced.

INTERIOR—type 304, 18-8 stainless, heli-arc welded gas-tight. All welds passivated.

EXTERIOR FINISH—baked-on attractive blue enamel. Front plate finished in high temperature aluminum paint.

INSULATION—Mono-Block and Fiberglas.

DOOR—double wall, same construction as unit. Silicone sponge rubber seal.

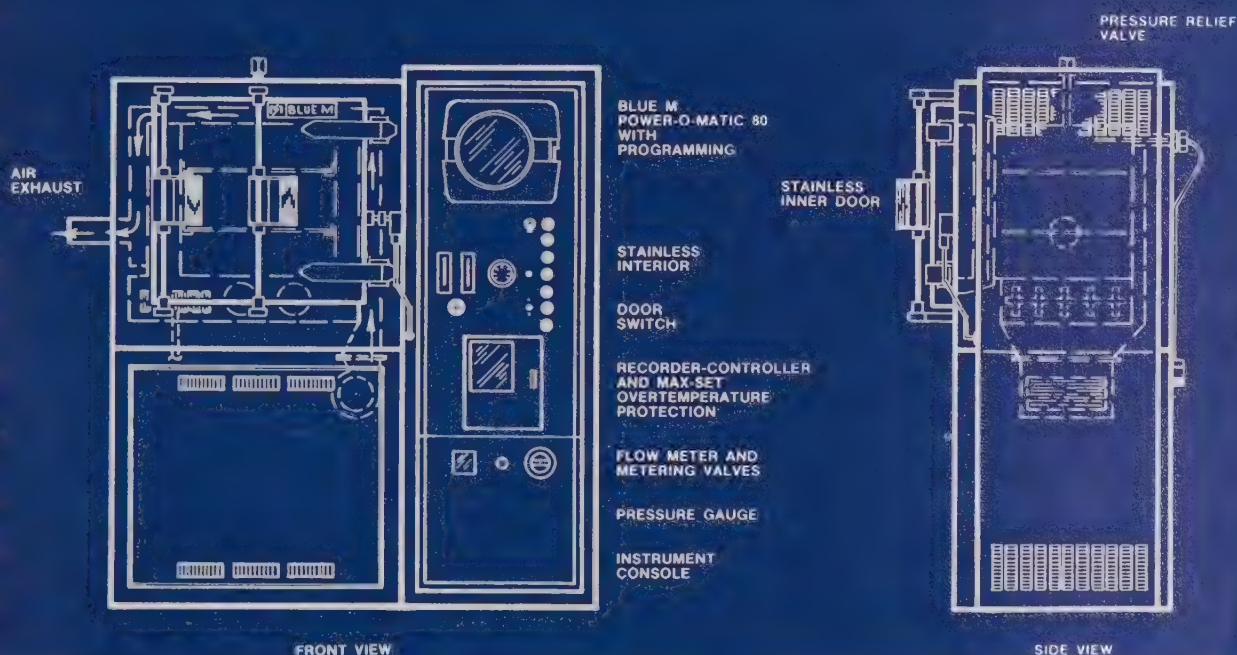
HARDWARE—two double cam-action latches to assure positive seal. Heavy-duty latches and hinges.

INNER DOOR—stainless steel with pivot type alloy hinge. Covers entire chamber opening. Reduces elevated chamber temperature to outer door seal.

**EQUIPMENT COVERED BY
OUR
EXCLUSIVE**

PARTS
WARRANTY
and
REPLACEMENT
SERVICE
PROGRAM

**BLUE M**



ETERNA HEATER BANKS—cylindrical type, assure years of service. Terminals effectively sealed to prevent gas loss.

ATMOSPHERE CIRCULATION—quality oversized ball bearing motor with electro-polished stainless blower wheel and shaft. Special high temperature shaft seal helps minimize gas loss and use.

SHELVES—two, 18-8 electro-polished stainless, adjustable on 2" centers.

MOTOR OVERLOAD PROTECTION—built-in thermal overload protection starter, interlocked with heating element circuit.

OPERATION

Turn on main switch. Controller automatically activates instrumentation for initial purging and for maintenance of inert gas atmosphere during process cycle. After purging, controller regulates temperature run-up and operational dwell time. At end of prescribed heating cycle, controller activates cooling system for rapid cool-down. Oven shuts off at end of program. Although program can be altered at will, any given program can be repeated with temperature regulation meeting exacting standards

APPROX. GAS FLOW RATES

MODEL	PURGE	RUN
IGF-6680	100 SCFH for 27 min.	30 SCFH
IGF-7780	200 SCFH for 18 min.	33 SCFH
IGF-8880	200 SCFH for 33 min.	65 SCFH
IGF-9980	600 SCFH for 24 min.	120 SCFH

Model Number	Inside Dimensions Inches (Cm.)			*Overall Dimensions Inches (Cm.)			Total KVA	Voltage 60 Hz. A.C. 3 Phase	Cubic Feet Cap.
	W.	D.	H.	W.	D.	H.			
IGF-6680PRF	20 (51)	18 (45)	20 (51)	38 (95)	35 (88)	76 (193)	10.0	240 V	4.1
IGF-7780PRF	25 (63)	20 (51)	20 (51)	45 (114)	37 (93)	76 (193)	13.0	240 V	5.8
IGF-8880PRF	38 (95)	20 (51)	25 (63)	61 (154)	36 (90)	72 (183)	15.0	240 V	11.0
IGF-9980PRF	48 (120)	24 (61)	36 (90)	71 (180)	40 (101)	83 (211)	21.1	240 V	24.0

*Not including 25" W. x 24" D. x 70" H. instrument console.
Other voltages available, all models: 208 V. and 480V./3Ph. 60 Hz. A.C.
All wiring complete and enclosed to meet N.E. Code, as amended.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: CURVE-TRACING PROGRAMMERS, RESERVE GAS SUPPLY SYSTEM, AND CASTERS.

SEND FOR ADDITIONAL INFORMATION AND ALL PRICES

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New York, Syracuse 13206

North Carolina, Charlotte 28210
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Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

OPERATING AND CONTROL CHARACTERISTICS

TEMPERATURE RANGE

+100°C. to +316°C. (+600°F.)

RUN-UP TIME (No Load)

60 minutes or less

COOL-DOWN TIME (No Load)

Maximum to +125°C. (+257°F.):
4½ hours

CONTROL ACCURACY: ±0.5°C.

SETABILITY: ±1.0°C.

REPEATABILITY: ±0.5°C.

TYPICAL AIR TEMPERATURE UNIFORMITY

At +150°C.: ±1.5°C.

At +300°C.: ±3.0°C.

BLUE M CERTIFICATION

All tests conducted with no load and stabilized chamber under normal conditions of voltage and ambient. When unusual line voltages, ambients, and severe loads exist, please contact local sales offices or factory for recommendations.

BLUE M GUARANTEE

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operating requirements.

APPLICATION:

How to process parts, materials or components in a non-oxidizing atmosphere when operation in conjunction with a dry box unit is necessary or desirable.

SOLUTION:

BLUE M NITROGEN DRY BOX BAKE OUT OVENS WITH REAR DOOR

with ~~POWER-O-MATIC~~ **POWER-O-MATIC 60**® Saturable Reactor Proportioning Control System.

These quality ovens—similar to the Inert Gas Ovens on pages 128 and 129—are equipped with a special rear door making them suitable for direct operation with a dry box unit.

Important features of these ovens include a heli-arc welded gas-tight stainless interior; cam action latches to hold doors firmly against silicone sponge rubber seals; sealed element terminals and motor shaft help minimize gas consumption; electropolished blower wheel and shaft. POWER-O-MATIC 60 Control assures excellent performance within very close tolerances. Oven and workload are safeguarded by independent, overtemperature protection.

Efficient manual gas control system consists of a gas flow meter with a metering valve. A pressure relief valve and a 0-3 PSI pressure gauge avoids possible build-up of internal pressure. All units undergo a positive pressure test with inert gas at various temperatures before shipment.

GENERAL SPECIFICATIONS

CONTROL SYSTEM

POWER-O-MATIC 60 Saturable Reactor Proportioning Control System.

MEMORY RING® Temperature Calibrating Dial.

DIAL POINTER LOCK

MAX-SET™ OVERTEMPERATURE PROTECTION

READY-READ TEMPERATURE INDICATOR—3½" diameter. Stainless sensing bulb. Dual scale in C. and F.

VOLTMETER

PILOT LIGHTS

GAS CONTROL SYSTEM

Manually operated gas flow meter with metering valve connected to ½" gas supply inlet on side of unit. Pressure relief valve and 0-3 PSI pressure gauge

eliminates possibility of gas pressure build-up inside chamber.

CONSTRUCTION

HOUSING—all-welded heavy gauge steel, reinforced.

INTERIOR—heavy gauge, type 304, 18-8 stainless. All seams welded gas-tight and passivated.

EXTERIOR FINISH—baked-on attractive blue enamel.

INSULATION—Fiberglas, 4" minimum.

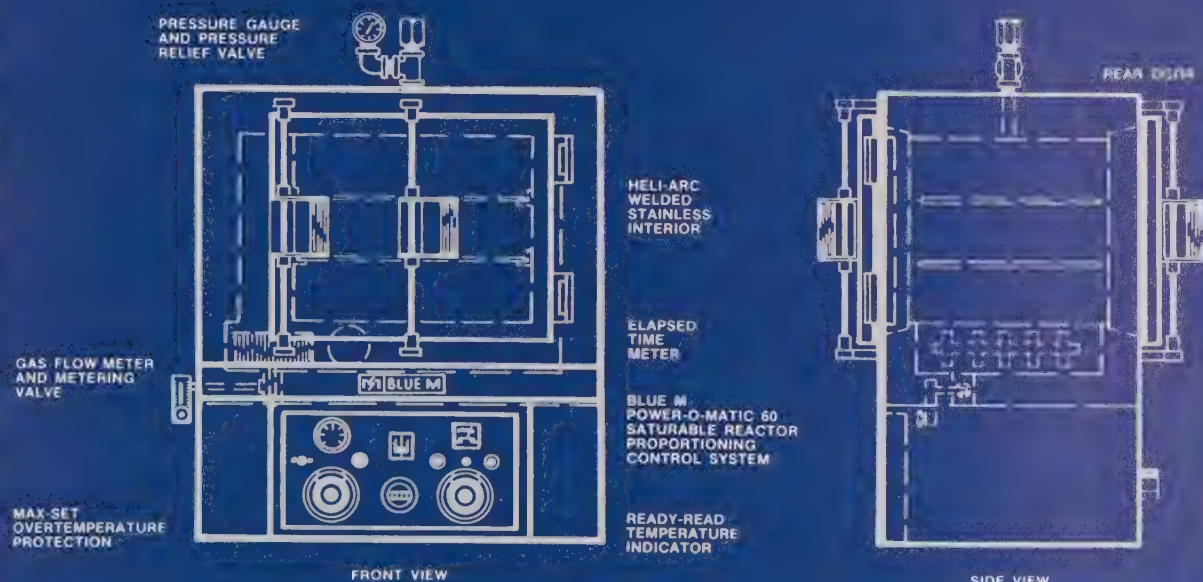
DOORS—double wall construction, same as unit. Silicone sponge rubber seals. Rear door hinged on right side.

HARDWARE—two double cam action latches per door, except small model which has one, to assure positive seal. Chrome-plated latches and hinges.

EQUIPMENT COVERED BY
OUR
EXCLUSIVE

PARTS
WARRANTY
and
REPLACEMENT
SERVICE
PROGRAM





ETERNA HEATER BANKS—cylindrical type, assure years of service. Terminals effectively sealed to prevent gas loss.

ATMOSPHERE CIRCULATION—quality oversized ball bearing motor with electropolished stainless blower wheel and shaft. Special high temperature shaft seal helps minimize gas loss and use.

SHELVES—two, electropolished stainless rod type or expanded metal with tubular frame, depending on model. Adjustable on 2" centers.

OPERATION

Introduce inert gas into chamber by means of metering valve on gas flow meter. Set control for desired temperature. Inert gas, heated by black heat, "controlled" low-watt density shielded ETERNA elements, propelled mechanically and horizontally across working chamber for uniform heat distribution. Atmosphere velocity through work space is approximately 250 F.P.M. NO RADIANT HEAT

APPROX. GAS FLOW RATES

MODEL	PURGE	RUN
ESP-146	100 SCFH for 11 min.	20 SCFH
ESP-206	100 SCFH for 27 min.	25 SCFH
ESP-256	200 SCFH for 18 min.	30 SCFH

GENERAL SPECIFICATIONS

Model Number	Inside Dimensions Inches (Cm.)			Overall Dimensions Inches (Cm.)			Total KVA	*Voltage 60 Hz. A.C. 1 Phase	Cubic Feet Cap.
	W.	D.	H.	W.	D.	H.			
ESP-146NBC-3	14 (35)	14 (35)	14 (35)	32 (80)	32 (80)	51 (128)	2.8	240V	1.5
ESP-206NBC-3	20 (51)	18 (45)	20 (51)	38 (95)	36 (90)	57 (144)	3.9	240V	4.1
ESP-256NBC-3	25 (63)	20 (51)	20 (51)	43 (109)	38 (95)	57 (144)	5.3	240V	5.8

*Other voltages available for all models: 208V. 1Ph., and 208V., 240V., and 480V./ 3 Ph. Write for details.

All wiring complete and enclosed to meet N.E. Code, as amended.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: EXTRA SHELVES, RECORDERS, AND AUTOMATIC PROGRAM TIMERS

SEND FOR ADDITIONAL INFORMATION AND ALL PRICES

BLUE M EQUIPMENT

A SALES AND SERVICE BRANCH OF
BLUE M EQUIPMENT COMPANY
Corporate Headquarters Blue Island, Illinois 60406

Arizona, Scottsdale 85251
California, El Monte 91731
California, Sunnyvale 94086
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**BLUE M**engineered
products in
ACTION**APPLICATION:**

How to process critical parts, components or materials to the most difficult and exacting performance standards.

OPERATING AND CONTROL CHARACTERISTICS**TEMPERATURE RANGE**

15°C. above ambient to +704°C.
(+1300°F.)

UNIFORMITY

±¼% of set point

CONTROL ACCURACY

±0.5°C.

COMBINED REPEATABILITY AND SETABILITY

±0.1% of scale

RUN-UP TIME

To +500°C. and +700°C.
No load and with rated voltage
is approximately 60 minutes and
90 minutes respectively.

PERFORMANCE

These fine chambers have been developed to meet extremely difficult applications. For such characteristics as stabilization, long term stability and accuracy at elevated temperatures, these units are superior to any other high-temperature oven in this catalog. As such they represent the ultimate in present-day oven design and operation.

SOLUTION:**BLUE M ULTRA-TEMP OVENS**

with ~~POWER-O-MATIC 80~~ ^{PATENTED} **Solid-State SCR Proportioning Control System,**

Separate Indication, Built-In Overtemperature Protection, and One-Pass Air-Flow System

Blue M's finest high temperature ovens—now completely redesigned to provide superior performance, improved appearance. Control panel and components are mounted on a sliding drawer which can be pulled forward for access to any part requiring inspection. A disconnect switch shuts off power when drawer is opened. An airflow switch insures proper blower rotation and automatically shuts down the oven if normal airflow through the chamber is stopped or drastically reduced. A new balanced 3-phase electrical system complements a new direct drive motor/blower system by assuring maximum efficiency from both the power used and from all electrical components.

The unmatched performance of these mechanical convection, horizontal airflow ovens stems from the POWER-O-MATIC 80 Control. Completely automatic and stepless, it assures straight-line performance . . . enables these quality chambers to outperform any other high temperature oven in this catalog.

Unique design includes a 10-turn potentiometer working in conjunction with Blue M's exclusive Memory Ring® Temperature Calibrating Dial to achieve remarkable setability, repeatability shown. Separate indication is ±1% of scale. SCR's are fused to protect them against failure. Ambient temperature compensation, line voltage compensation and overtemperature protection are built-in.

The indicating overtemperature protection, with MAX-SET circuitry, and control system are separate and distinct from one another, and operate independently with individual thermocouples. This outstanding design feature means that the indicator provides a true and accurate representation of actual chamber conditions. It enables the operator to "see" exactly what's going on inside the oven—regardless of the control setting. The same is true of the OTP: it functions in direct response to chamber conditions only. This unique design innovation in itself makes these ovens distinctive from any other on the market, and offers final assurance of their engineering and operational superiority.

GENERAL SPECIFICATIONS**CONTROL SYSTEM**

POWER-O-MATIC 80 Solid-State SCR Proportioning Control System—offers infinitely proportional, true straight-line performance throughout the unit's range. Designed specifically for control of elevated temperatures. Including a 10-turn potentiometer and working in conjunction with Blue M's patented Memory Ring® Temperature Calibrating Dial, POWER-O-MATIC 80 offers an expanded scale length of over 70" for remarkable setability/repeatability. Dual scale in C. and F.

BUILT-IN OVERTEMPERATURE PROTECTION: Indicating type, dual scale with range to complement main control and installed conveniently adjacent to it. Indication accuracy ±1% of full scale. Provides constant monitoring over entire span; you see what the chamber temperature actually is at all times. Operates independently of control in response to its own thermocouple. Features exclusive Blue M MAX-SET time-delay circuitry.

MOTOR OVERLOAD PROTECTION

DUAL ELEMENT THERMOCOUPLE—one for control, one for OTP. Break protection: unit shuts down automatically if T/C fails. Fast response.

MAIN SWITCH**PILOT LIGHT****CONSTRUCTION**

HOUSING—all-new, all-welded heavy gauge steel, reinforced. Heavy steel front plate with high temperature aluminum paint finish.

INTERIOR—type 304, 18-8 stainless.

EXTERIOR FINISH—baked-on attractive baked enamel.

INSULATION—special 6" thick, +1600°F. material.

DOOR(S)—new air-shielded design with inner and outer 18-8 stainless bellows type, leak-proof seal. Largest model has two doors, but no center door.

HARDWARE—new, rugged heavy-duty hinges and pivot-lock latch.

EQUIPMENT COVERED BY**OUR****EXCLUSIVE**

PARTS
WARRANTY
and
REPLACEMENT
SERVICE
PROGRAM

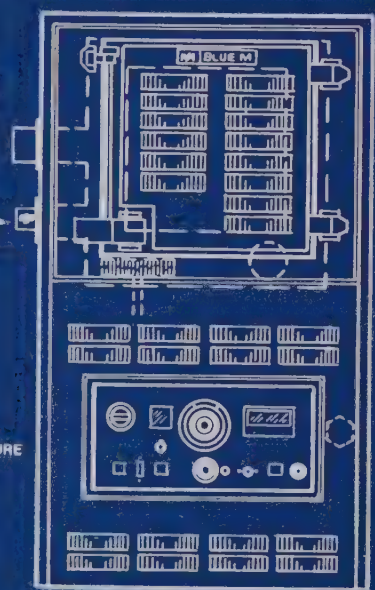


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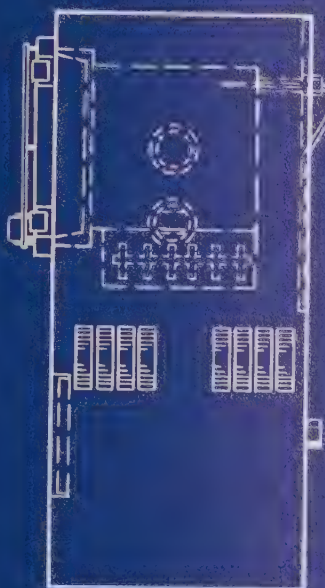
**BLUE M**

A BLUE M

STANDARD



FRONT VIEW



SIDE VIEW

ONE-PASS
AIR-FLOW
SYSTEM

POSITIVE
AIR INTAKE

INDICATING
MAX-SET
OVERTEMPERATURE
PROTECTION

ALL-NEW
ALL-WELDED
HEAVY GAUGE
REINFORCED STEEL
CONSTRUCTION
STAINLESS INTERIOR

STAINLESS
BELLOWS TYPE
DOOR SEALS
AND INDUSTRIAL
HARDWARE

AIR-SHIELDED
DOOR

BLUE M
POWER-O-MATIC 80
SOLID-STATE SCR
PROPORTIONING
CONTROL SYSTEM

10-TURN
POTENTIOMETER

MAIN SWITCH

DIRECT DRIVE
MOTOR/BLOWER
SYSTEM

THERMOCOUPLES (2)
FOR INDEPENDENT
CONTROL AND OTP

ETERNA
HEATER
BANKS

ETERNA HEATER BANKS—cylindrical type, assure years of service. Shielded. No radiant heat.

DIRECT DRIVE MOTOR/BLOWER—no bearings, pulleys or belts. Extra large, fan-cooled motor drives multi-bladed blower directly.

SHELVES—two, expanded stainless with angle framing, or wire rod type, depending on model. Adjustable every 2".

ADJUSTABLE ONE-PASS AIR-FLOW SYSTEM—tempered air passes over heaters and through chamber only once if necessary for low temperature operation, maximum fume exhaust.

OPERATION

Set control for desired temperature. Air, heated by black heat, "controlled" low-watt density shielded ETERNA elements, propelled mechanically and horizontally by alloy pressure type fan and quality motor through definite air-flow pattern. After passing across chamber, the heated air returns through the heater banks. Air velocity through work space is approximately 350 F.P.M. NO RADIANT HEAT.

GENERAL SPECIFICATIONS

Model Number	Inside Dimensions Inches (Cm.)			Overall Dimensions Inches (Cm.)			Total KVA	*Voltage 60 Hz. A.C. 3 Phase	Cubic Feet Cap.
	W.	D.	H.	W.	D.	H.			
POM-5580F-2	14 (35)	14 (35)	14 (35)	39 (98)	31 (78)	61 (154)	7.0	240V	1.6
POM-6680F-2	20 (51)	18 (45)	20 (51)	45 (113)	35 (88)	67 (170)	10.0	240V	4.1
POM-7780F-2	25 (63)	20 (51)	20 (51)	50 (127)	37 (93)	67 (170)	13.0	240V	5.8
POM-8880F-2	38 (95)	20 (51)	25 (63)	63 (159)	37 (93)	72 (183)	15.5	240V	10.2
POM-9980F-2	48 (120)	24 (61)	36 (90)	73 (185)	41 (104)	83 (211)	21.1	240V	24.0

*Other voltages available for all models: 208V. and 480V./3 Ph.

All wiring complete and enclosed to meet N.E. Code, as amended.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE. TIME-TEMPERATURE PROGRAMMER, LEAD-IN PORTS, RECORDERS, VYCOR® VIEWING PANELS AND AUTOMATIC PROGRAM TIMERS.

BLUE M CERTIFICATION

All tests conducted with no load, no exhaust, and stabilized chamber under normal conditions of voltage and ambient. When unusual line voltages, ambients, severe loads and exhaust rates exist, please contact local sales offices or factory for recommendations.

BLUE M GUARANTEE

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operating requirements.

SEND FOR ADDITIONAL INFORMATION AND ALL PRICES

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Washington, Seattle 98108

OPERATING AND CONTROL CHARACTERISTICS

TEMPERATURE RANGE
+150°C. to +704°C. (+1300°F.)

RUN-UP TIME (No Load)
To +675°C.: 55 minutes

INDICATION ACCURACY
±1% of scale

CONTROL TOLERANCE: ±5°C.

TYPICAL AIR TEMPERATURE UNIFORMITY
At +250°C.: ±2.5°C.
At +500°C.: ±5.0°C.

BLUE M CERTIFICATION

All tests conducted with no load, no exhaust, and stabilized chamber under normal conditions of voltage and ambient. When unusual line voltages, ambients, severe loads and exhaust rates exist, please contact local sales offices or factory for recommendations.

BLUE M GUARANTEE

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operating requirements.

APPLICATION: How to establish the best heat-treating procedure to assure optimum annealing of various types of glass and space-age alloys.

SOLUTION:

BLUE M TEMP-O-LOY ANNEALING OVENS

Many types of glass, like certain steels and alloys, require a certain temperature before they acquire maximum ductility. Length of heat-time and size, shape, thickness and other characteristics of the material also influence the particular heat-treating procedure required. Accordingly, no one specific program can be arbitrarily selected and be expected to provide the desired results. The optimum procedure can be determined only on the basis of past experience—and through the use of quality-built, reliable annealing equipment. The much sturdier design and construction of Blue M Temp-O-Loy Annealing Ovens more than compensate for their higher prices over ordinary equipment.

Blue M Mechanical Convection, Horizontal Air-Flow Annealing Ovens are the ideal means to first help establish proper procedures and then to maintain them with a fine degree of accuracy throughout prolonged production runs. Engineered to the highest standards and ruggedly built of the finest materials these units are meeting the strictest requirements for annealing glass, and for pre-heating, stress-relieving, forming and heat-treating magnesium, titanium and other more exotic alloys. Blue M Temp-O-Loy Ovens meet Air Forces Spec. MIL-H-6088C. Our 1400°F. rated motor/blower system is especially designed for elevated temperatures.

The unit is illustrated with a manually operated vertical rise door. For operator convenience, an air-operated door opening system is available.

GENERAL SPECIFICATIONS

CONTROL SYSTEM

SOLID STATE INDICATING CONTROL POTENTIOMETER—fully automatic, with built-in time proportioning. Illuminated direct read-out dial with 8" scale provides setting accuracy to within 0.5% of scale. Centigrade standard; Fahrenheit available on special order.

MAX-SET™ OVERTEMPERATURE PROTECTION—similar solid-state instrument complements control, provides positive protection for workload and unit. 8" scale. Features MAX-SET™ time delay circuitry.

THERMOCOUPLE AND LEAD WIRE—24 ga. 1/C Inconel sheathed T/C with MgO insulation and 10' of 20 ga. 1/C T/C wire.

CONTACTOR—mercury relay.

MOTOR OVERLOAD PROTECTION—built-in thermal overload protection.

MAIN SWITCH

PILOT LIGHT

CONSTRUCTION

HOUSING—all-welded and reinforced heavy gauge steel, 3/16" thick. Housing front is 1/2" thick steel plate, aluminum paint.

WALLS—triple side walls.

INTERIOR—extra heavy gauge stainless.

EXTERIOR FINISH—attractive blue enamel.

INSULATION—firebrick, Fiberfrax and Fiberglas.

DOOR—counter-balanced, chain sprocket-ball bearing lift. Rugged construction. (Air-operated door optional).

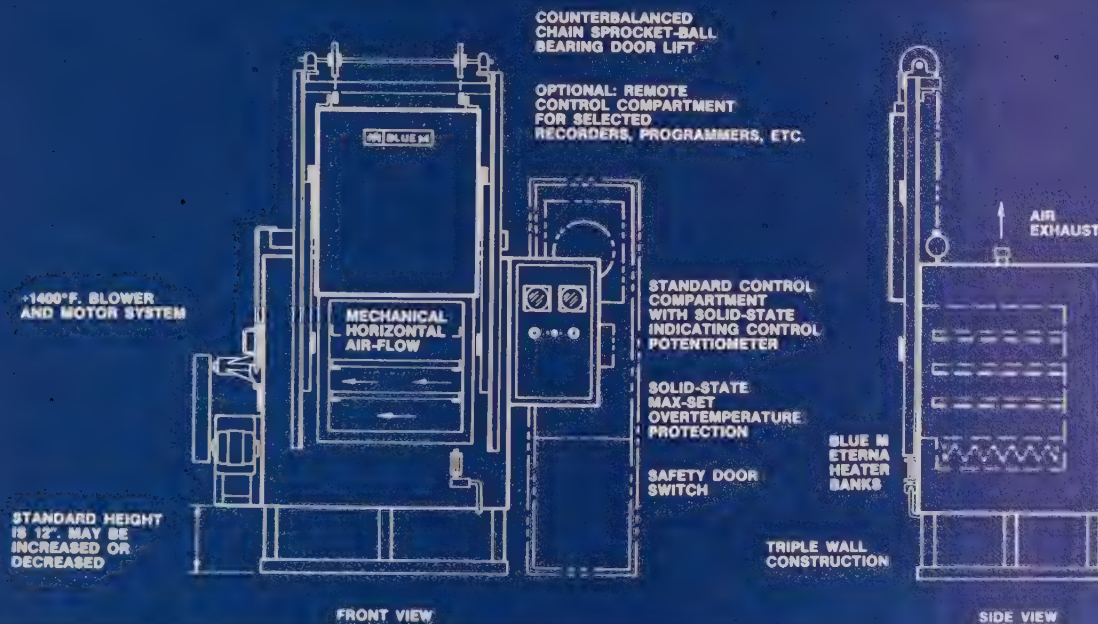
ETERNA HEATER BANKS—cylindrical type, assure years of service.

SHELVES—two stainless steel angle construction. Removable.



A BLUE M

STANDARD



SHELF SUPPORTS—alloy angles every 6".

1400°F. MOTOR/BLOWER SYSTEM—extra heavy alloy blade wheel statically and dynamically balanced. Air-cooled shaft sleeves. Air-cooled ball bearing motor with adjustable V-Belt drive.

SAFETY-DOOR SWITCH — automatically breaks heater circuit when door is opened.

FLOOR STAND—normally supplied 12" high. Other sizes available; please specify.

REMOTE CONTROL COMPARTMENT (OPTIONAL)—wiring compartment, for U.L. Listed electrical equipment, can be mounted in separate 25" W. x 70" H. x 24" D. compartment instead of at side of oven when so ordered.

OPERATION

Set control pointer to required temperature. Air, heated by low gradient cylindrical type shielded ETERNA elements, is propelled across working chamber by 1400°F. motor/blower system for uniform heat distribution. Working temperature is automatically held to a fine degree of accuracy. NO RADIANT HEAT.

GENERAL SPECIFICATIONS

Model Number	Inside Dimensions Inches (Cm.)			Overall Dimensions Inches (Cm.)			Total KVA	*Voltage 60 Hz. A.C. 3 Phase	Cubic Feet Cap.
	W.	D.	H.	W.	D.	H.			
TLG-24-1F-1	24 (61)	24 (61)	24 (61)	81 (205)	42 (106)	93 (236)	21.4	240V.	8.0
TLG-30-1F-1	30 (76)	48 (120)	30 (76)	96 (244)	70 (177)	108 (270)	42.9	240V.	25.0
TLG-36-1F-1	36 (90)	48 (120)	36 (90)	103 (262)	70 (177)	120 (300)	52.0	240V.	36.0
TLG-36-2F-1	36 (90)	24 (61)	36 (90)	96 (244)	46 (116)	120 (300)	38.7	240V.	18.0
TLG-36-3F-1	36 (90)	36 (90)	48 (120)	103 (262)	58 (147)	144 (360)	52.0	240V.	36.0

*Other voltage available for all models: 480V./3 Ph. Write for details.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: TIME-TEMPERATURE PROGRAMMER, LEAD-IN PORTS, RECORDERS, VYCOR® VIEWING PANELS AND AUTOMATIC PROGRAM TIMERS.

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**BLUE M**engineered
products in
ACTION**OPERATING AND CONTROL CHARACTERISTICS*****TEMPERATURE RANGE****CAPABILITIES****(LINEAR PROGRAMMING)**

from +120°F. to +400°F. (+204°C.)

from +400°F. to +120°F. (+49°C.)

(Special range to +600°F.
also available)**CONTROL ACCURACY:** $\pm 0.5^{\circ}\text{C}$.**SETABILITY:** $\pm 1.0^{\circ}\text{C}$.**REPEATABILITY:** $\pm 0.5^{\circ}\text{C}$.**TYPICAL AIR TEMPERATURE UNIFORMITY**At +200°C.: $\pm 2.5^{\circ}\text{C}$.

*Linear program rates may be extended to +10°F. above ambient with one-pass airflow. Motorized damper required to actuate at +120°F. Open exhaust necessary for temperatures under +120°F.

NOTE: Cost of polymer models often exceed oven cost. Therefore, we have incorporated as standard a secondary back-up control. Since temperature cannot rise or fall more than +10°F. from any point in the program in event of primary control failure, this special control permits continued operation rather than shut down.

APPLICATION:

How to determine the nature and possible cause of stress patterns in transparent polymer models as an aid to more efficient and economical production techniques.

SOLUTION:**BLUE M PHOTOELASTICITY OVENS**

with ~~POWER-O-MATIC~~ **POWER-O-MATIC 60**® Saturable Reactor Programmer-Controller, Separate Monitoring Recorder, and Special Secondary Back-Up Control.

The inherent reliability and accuracy of the POWER-O-MATIC 60 Non-Cycling Programme Controller, with our quality cabinets of specific volume, produce an ideal tool for the study of stress patterns in transparent polymer models which generally occur in manufacture.

Typically, a polymer model or sample is slowly heated to and held at a pre-determined temperature for several hours for drying. This eliminates trapped water vapor, acquired during formation or through absorption of humidity, which renders stress pattern incomplete. After drying, temperature is gradually increased to annealing point to relieve residual stress pattern. This is followed by gradual cooling back to ambient—important since additional stresses can be introduced if this is not controlled properly.

Conversely, a polymer model is subjected to this stress-relieving process, or a stress-free polymer is machined as the model. Stress is then physically applied at a predetermined temperature and the temperature is gradually decreased, "freezing" the stress pattern for study. Such a "3-D Stress Pattern Freezing" cycle can be programmed as follows: heat from +80°F. to +300°F. at 3°F. per hour; hold at +300°F. for 15 hours; cool from +300°F. to +80°F. at 3°F. per hour. While the basic programmer cam motor has a 24 hour revolution tests may be extended considerably by use of a built-in percentage timer. However, for test requiring duration of 28 days (14 days up and down) or 60 days (30 days up and down) special 14 day or 30 day program timers are available as an option. Since control accuracy is limited only by cam cutting accuracy, excellent uniformity and reliability are assured. Close control, coupled with a superior mechanical convection, horizontal (one-pass) air-flow oven, provides research/production specialists with a dependable testing tool which more than pays for itself by indicating more effective manufacturing techniques. We can also apply this reactor programming system to a series of Gravity Convection Ovens.

*With use of motorized damper.

GENERAL SPECIFICATIONS**CONTROL SYSTEM**

POWER-O-MATIC 60 Saturable Reactor Programmer-Controller with separate monitoring recorder.

SPECIAL SECONDARY BACK-UP CONTROL—(See note under Operating Characteristics for details)

RECORDER—single pen, temperature range to match oven. 24 hour cam motor.

PERCENTAGE TIMER—controls on-time of cam motor as required for extended programs.

VOLTMETER**PILOT LIGHTS****CONSTRUCTION**

HOUSING—all-welded #14 and #16 gauge cold rolled steel, reinforced.

WALLS—triple side walls.

INTERIOR FINISH—aluminum paint.
(Stainless optional).

EXTERIOR FINISH—attractive blue enamel.
(Stainless optional).

INSULATION—Fiberglas.

DOOR—double wall type, insulation and construction same as unit. Industrial hardware. Silicone rubber seal.

VIEWING PANELS—strain-free PYREX glass, 13" W x 19½" H. in door and rear wall. Carefully aligned with one another to facilitate viewing of polymer models with polaris light and filtering lenses.

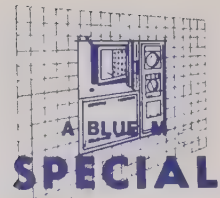
ETERNA HEATER BANKS—cylindrical type, assure years of service. Shielded. No radiant heat.

DIRECT DRIVE AIR CIRCULATION—quality ball bearing motor and balanced multi-bladed blower designed especially for these units. No bearings, pulleys or belts.

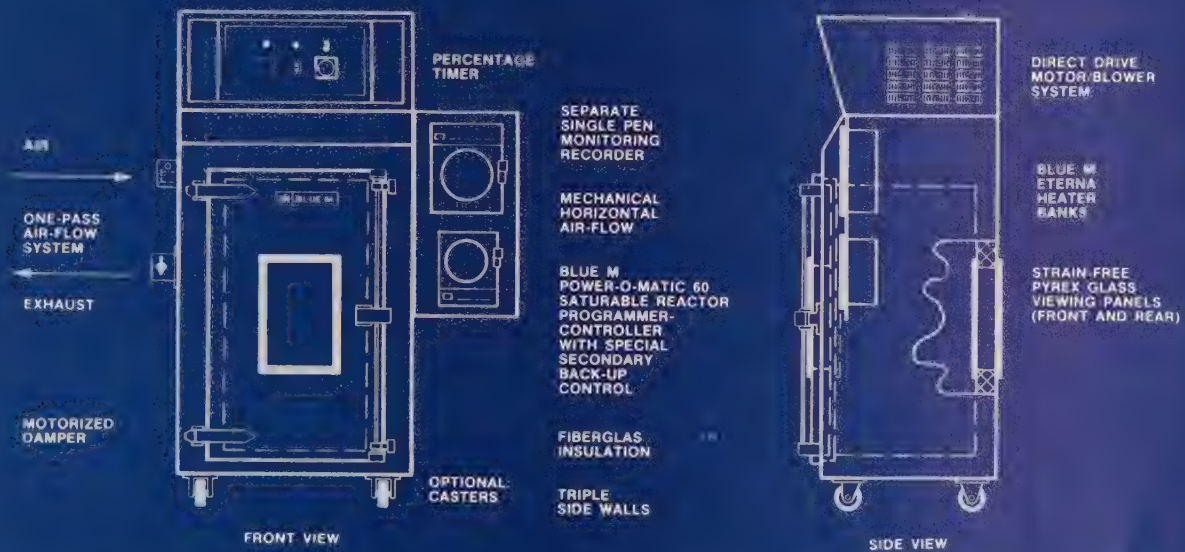
EQUIPMENT COVERED BY
OUR
EXCLUSIVE

PARTS
WARRANTY
and
REPLACEMENT
SERVICE
PROGRAM

**BLUE M**



OVENS



ADJUSTABLE ONE-PASS AIR-FLOW—tempered air passes over heaters and through chamber only once if necessary. Permits 100% exhaust. Higher K.W. rating recommended for maximum temperature if exhaust rate is needed. Motorized damper now standard.

OPERATION

Turn on cam drive. **ONE-PASS AIR-FLOW SYSTEM:** Air is drawn through adjustable intake port near top of oven and over black heat, "controlled" low-watt density shielded ETERNA elements. It is then propelled through working chamber once through an adjustable exhaust port. Positive control of circulation and exhaust rates assures uniform distribution in accordance with program outlined on the cam. Since Blue M's reactor system is non-cycling, accuracy of temperature control is limited only by the accuracy of the cam, and virtually any desired program is possible. **NO RADIANT HEAT.**

GENERAL SPECIFICATIONS

Model Number	Inside Dimensions Inches (Cm.)			Overall Dimensions Inches (Cm.)			Total KVA	Voltage 60 Hz. A.C. 3 Phase	Cubic Feet Cap.
	W.	D.	H.	W.	D.	H.			
POM-163PEE	24	24	48	61	37	83	10.0	208 V.	16.0
POM-163PEF	(61)	(61)	(120)	(154)	(93)	(211)		240V.	
POM-163PEG								480 V.	
POM-243PEE	36	24	48	73	37	83	10.0	208 V.	24.0
POM-243PEF	(90)	(61)	(120)	(185)	(93)	(211)		240 V.	
POM-243PEG								480 V.	

All wiring complete and enclosed to meet N.E. Code, as amended.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: CASTERS, LEAD-IN PORTS, STAINLESS STEEL INTERIORS, ACCESS PORTS TO MANIPULATE SAMPLES, INTERIOR LAMP AND SWITCH, AIR-FLOW SWITCH, PROGRAMMER CLOCK MOTORS, 14 DAY OR 30 DAY REVOLUTION, CUT CAMS AND BLANK CAMS.

BLUE M GUARANTEE

When applications are factory approved, we **GUARANTEE** to supply unit(s) meeting your operating requirements.

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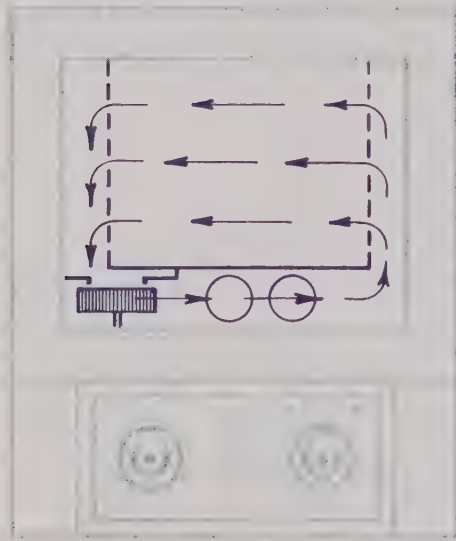
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MODIFICATIONS OF STANDARD HORIZONTAL AIR-FLOW PATTERNS MAKE ECONOMICAL BLUE M OVENS SUITABLE FOR SPECIALIZED APPLICATIONS

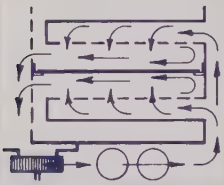
**STANDARD BLUE M
HORIZONTAL AIR-FLOW OVEN**



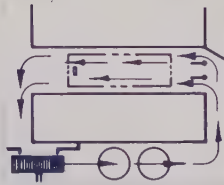
All standard horizontal air-flow ovens undergo some minor restrictions that make them less applicable for many specialized applications. Failure to recognize and understand these limitations can cause improperly processed loads, erratic results, and general dissatisfaction with the equipment.

The problem basically is that some individuals attempt to accomplish a sophisticated bit of processing in a chamber that is inherently incapable of performing it. They try to do the impossible, in other words. And the heart of the problem is the air circulation system and related air-flow pattern in a typical standard unit.

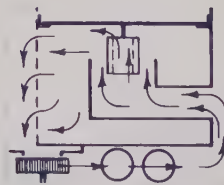
A high pressure squirrel cage blower is normally employed to force sufficient CFM through dense loads. The blower is small in relation to the overall oven volume. It may, for example, have a blower scroll discharge area of 20 sq. in., from which the air must be dispersed over a 400 sq. in. oven cross-sectional area. Usually, air is discharged into the oven work zone as evenly as possible through a perforated inner wall, or plenum, as shown in the illustration of a typical oven at left. The plenum wall on the right side is a high pressure area, and air is forced through the holes in high velocity jets ranging from 1200 to 1800 FPM right to the point of discharge. These high velocity jets converge a few inches away from the wall and velocity falls off very rapidly to rates below 100 FPM in some areas.



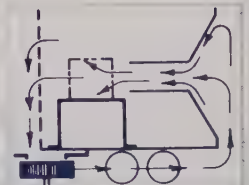
Designed for fast, uniform heating of single, flat plastic sheets. High velocity air strikes entire area from both top and bottom. This design is also suitable for fast paint bake cycles on flat sample panels.



Designed for extremely high velocity requirement of 900 FPM. To design entire oven to this velocity figure requires an impractical size blower system. By ducting entire existing blower capacity into a narrow channel, desired velocity is obtained. Inner duct has small door for loading and unloading test sample.



Designed for fast cure of coating applied to thick walled, metal cylinder. Normal loading in horizontal air-flow oven produced overcuring of cylinder exterior by the time the interior cure temperature was reached.



Designed to allow a row of small stainless steel molds to closely follow a fast air temperature program cycle.

Such variations in velocity are normal, and have little effect on most heating applications. There are some, however, where variations of this nature and magnitude defeat any possibility of obtaining the desired test/processing results. A few examples of such applications include:

1. Piece part temperatures must rise at a uniform rate. This is particularly difficult when parts are of materials that are poor heat conductors—glass, plastics, etc.
2. Fast cycle curing operations on plastic sheets or strips.
3. Fast bake cycles on painted test panels.
4. Piece part temperatures must closely follow air temperature through fast, automatic program cycle. Fiber-optics work is a good example of this condition.
5. Applications requiring air velocities that are higher than practical in a standard oven, and applications requiring a uniform velocity.
6. Still air applications requiring tight control and temperature uniformity tolerances at near zero velocity.

There are three basic factors that control the temperature rate rise of a given piece part, discounting its thermal properties: (1) temperature difference between the part and

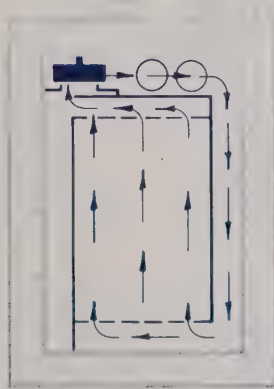
the air around it; (2) air velocity; (3) the uniformity of the velocity over the total surface area of the part. These characteristics are obviously fixed in standard ovens, and unless they are suitable for the application in question, the results will be unsatisfactory.

The illustrations shown here are examples of interior duct designs which Blue M has engineered to meet the specialized requirements mentioned above. Their purpose is primarily to concentrate the entire heating and air delivery capacity of the oven to one small zone or one single point and/or change the direction of the air-flow to suit the peculiarity of the load's size and shape. Often such special side walls and ductwork have been supplied in addition to standard side walls and shelves. This enables the user to convert the unit to a standard oven configuration for all work requiring maximum loading capabilities in about one hour.

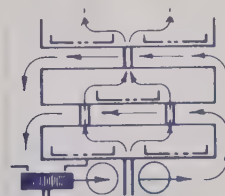
We emphasize that these are only a few examples of many modifications which have been made to convert standard Blue M ovens into highly specialized test/processing chambers. If you have experienced difficulty in the results you expect from standard equipment, or if your experience indicates that a particular application may require a special modification, please keep this Blue M ability in mind. Chances are excellent that we have already solved a similar problem, and can meet your requirements quickly and economically.



Illustrates standard procedure of supplying any Blue M horizontal air-flow oven for vertical air-flow applications. Oven is mounted on its side with vertical designed control panel, door rehinged and shelf brackets relocated. Normally supplied with a floorstand. Oven can be supplied rotated 180° to provide top to bottom air-flow.



Basically the same conversion as at left applied to Blue M Industrial Batch Ovens where HEIGHT is required and/or floor space must be conserved.



Unique approach to provide zero velocity and tight temperature control and uniformity. For processing and drying of extremely fine powders that can become air-borne with slightest movement of air. In this case, ductwork completely isolates work zones from air recirculating system. Each of the ducts, top, bottom and side walls becomes efficiently and uniformly heated "hot plates" surrounding each work zone. Powders loaded in shallow trays, dishes, etc.

BLUE M EQUIPMENT

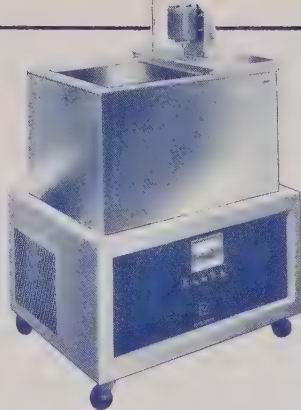
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BLUE M EQUIPMENT COMPANY

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California, Sunnyvale 94086
Florida, Orlando 32789
Georgia, Atlanta 30341

Illinois, Blue Island 60406
Massachusetts, Framingham 01701
Michigan, Allen Park 48101
New York, Elmsford 10523
New York, Syracuse 13206

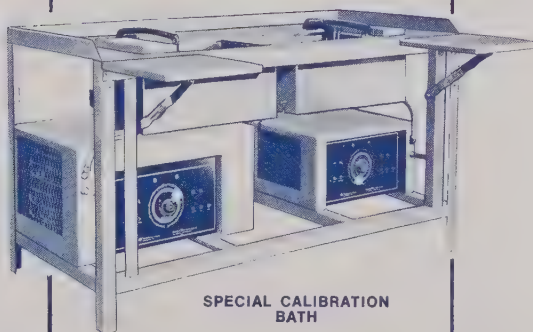
North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108



REFRIGERATED
WATER BATH



HIGH POWERED
WATER BATH



SPECIAL CALIBRATION
BATH

BLUE M CONSTANT TEMPERATURE BATHS AND

Blue M Constant Temperature Oil and Water Baths are playing an increasingly important testing role wherever absolute temperature uniformity and reliability are important. They are particularly valuable in enabling manufacturers of electronic components to meet stringent MIL and JAN specifications. These baths are also important production tools since they satisfy the growing demand in general industry for tighter quality control during manufacturing testing and production. Often a single type of Blue M Bath can serve both the research specialist and the production manager, affecting a considerable saving over the cost of separate units.

The baths pictured here and described on the following pages all perform this desirable and economical joint test/production function. All are built to Blue M's own high standards of excellence, but each of them offers distinct features tailoring them to specific jobs.

For example, some of them incorporate the exclusive POWER-O-MATIC 60® Saturable Reactor Proportioning Control System—a feature which automatically assures an unduplicated degree of temperature control and operational reliability. Ambient temperature compensation is only one of the many accessories available to improve bath performance.

Several of these baths also feature the patented, fully automatic built-in MAGNI-WHIRL® agitation system which obsoletes old fashioned circulating methods and mechanical stirrers. An automatic, self-timing electromagnet below the bottom non-magnetic wall, periodically pulsates counterweighted rocker agitator plate. Variable, timed rocking motion of agitator provides complete, gentle, quiet agitation and circulation throughout entire liquid mass, irrespective of how heavily bath is loaded. D.C. electromagnetic energized and de-energized by a quality solid-state D.C. "package power supply" consisting of a Resistor-Capacitor network coupled into a unijunction transistor driving an SCR. With no moving parts, this system assures long, trouble-free operation.

Besides overall accuracy throughout the entire temperature range, these Blue M Baths provide 100% accessible and usable working areas. Removable electro-polished stainless steel element assembly makes cleaning quick and easy. A push-button reset switch protects the magnet and power supply, an important safety feature, and an external means to compensate for line voltage variations is also provided.

EQUIPMENT COVERED BY
OUR
EXCLUSIVE

PARTS
WARRANTY
and
REPLACEMENT
SERVICE
PROGRAM



CONSTANT-FLOW PORTABLE COOLING UNITS

The versatility of the various units in this section is perhaps best exemplified by the series of Versa-Whirl Constant Temperature Baths. These unusually fine units are exceptionally well suited for such precise operations as instrument calibration. In addition, they have been engineered to meet thermal shock test conditions A to F of Mil. Std. 883, Method 1011. A new Versa-Whirl Bath features a fully automatic load transfer system. These units become a significant addition to the Blue M line of Thermal Shock Chambers described earlier in this catalog.

Unique among the equipment in this section are the Constant-Flow Portable Cooling Units. Included here because of their utility as an auxiliary cooling source for baths as well as for other equipment, these coolers have a virtually unlimited flexibility. And added to this

inherently broad operational scope is Blue M's ability to custom-engineer cooling coils in a variety of configurations to meet specific needs exactly.

The many important advances outlined here and described in detail on the following pages make Blue M Baths the accepted standard wherever unmatched operating performance is a prime consideration. In addition to the Baths described here, we have the experience and facilities to produce a variety of other specialized units to fit virtually any requirement. If your application—no matter how unusual—requires a bath that you can depend upon without question, outline your requirements to your nearest Blue M Branch Office, or write us direct for a prompt, effective solution to your needs.

BLUE M BATHS AND PORTABLE COOLING UNITS

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VERSA-WHIRL BATH



CONSTANT-FLOW PORTABLE COOLING UNITS

BLUE M EQUIPMENT

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BLUE M EQUIPMENT COMPANY
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Michigan, Allen Park 48101
New York, Elmsford 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

APPLICATION: How to keep high liquid bath temperatures uniform and constant over an extremely wide range with accuracy, uniformity and reliability.

OPERATING AND CONTROL CHARACTERISTICS

TEMPERATURE RANGE
+45°C. to +260°C. (+500°F.)

CONTROL ACCURACY: $\pm 0.1^\circ\text{C}$.

SETABILITY: $\pm 1.0^\circ\text{C}$.

REPEATABILITY (MID-SCALE):
 $\pm 0.5^\circ\text{C}$.

TYPICAL LIQUID UNIFORMITY
At +200°C.: $\pm 0.25^\circ\text{C}$.

TEMPERATURE DRIFT
At +100°C.: $\pm 0.2^\circ\text{C}$.
At +200°C.: $\pm 0.4^\circ\text{C}$.

BLUE M CERTIFICATION

All tests conducted with no load, and stabilized bath under normal conditions of voltage and ambient. When unusual line voltages, ambients, and severe loads exist, please contact local sales offices or factory for recommendations.

BLUE M GUARANTEE

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operating requirements.

SOLUTION:

BLUE M CONSTANT HIGH TEMPERATURE

Magni Whirl® UTILITY OIL BATHS
PATENTED IN U.S.A. AND CANADA

with **POWER-O-MATIC 70®** Solid-State Proportioning Control System.

Unusually close high temperature control and complete operational reliability are inherent in these Blue M MAGNI-WHIRL Oil Baths. The exclusive POWER-O-MATIC 70 Solid-State Proportioning Control System assures performance that meets even the most critical standards. The built-in MAGNI-WHIRL system, which replaces the usual stirrers or circulating methods, gently and automatically agitates the entire liquid volume equally to provide excellent temperature uniformity (see operating characteristics) at any point from +45°C. to +260°C.

These baths are ideal for stability testing, conditioning, preheating and tempering in the research laboratory or for production purposes. They are designed for use with heat transfer fluids such as Polyalkylene Glycol *(UCON), stable oil fluids and with water.

Vastly improved MAGNI-WHIRL system provides faster agitation, greater dependability, longer life, less maintenance. Timing and power relays are eliminated in agitation system . . . operation is silent . . . agitator pulse rate is variable . . . fluid directional flow is improved . . . normal variations in line voltage can be ignored . . . special ambient temperature compensation built-in.

Other outstanding features of these baths include a removable stainless element assembly for easy tank cleaning . . . recessed control panel . . . push-button safety reset switch to protect magnet and D.C. power supply—providing unequalled operating performance and convenience. No moving parts—no repairs, oiling or adjustments. 100% accessible and usable working area. MAX-SET overtemperature protection, now standard, safeguards workload and equipment.

A wide variety of other sizes and ranges for both water and oil liquids—with or without refrigeration—is also available. Write for details.

*Trademark of U.C.C. Co.

GENERAL SPECIFICATIONS

CONTROL SYSTEM

POWER-O-MATIC 70 Solid State Proportioning Control System.

MEMORY RING® Temperature Calibrating Dial.

DIAL POINTER LOCK

MAX-SET™ OVERTEMPERATURE PROTECTION

MAIN CIRCUIT BREAKER

PILOT LAMPS (2)

NEW SOLID-STATE PACKAGED POWER SUPPLY—no timing relays—reliable and trouble-free. Magnet coil and power supply unit protected by KLIXON®

bi-metal thermostat; touch on button plunger repositions protector for instantaneous resumption of normal operation.

CONSTRUCTION

HOUSING—double wall type. Oil chamber and outer jacket type 304, 18-8 stainless. All edges and joints heli-arc welded and passivated.

INSULATION—Fiberglas around oil chamber. Transite and Mono-Block in bottom area.

ELEMENTS—removable. Sheath design, tubular, type 316 stainless with "cold end" terminals. No welded fittings to receive elements.

DRAIN—solid brass, nickel-plated.



A BLUE M



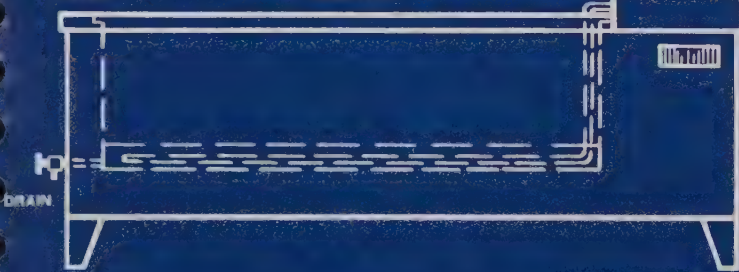
STANDARD

ALL STAINLESS
CONSTRUCTION
HELI-ARC
WELDED

FIBERGLAS
INSULATION

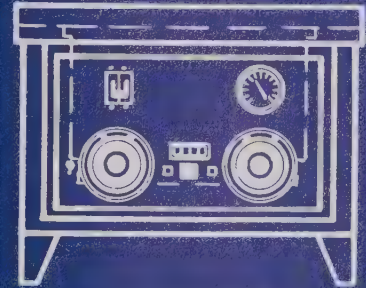
REMOVABLE
SHEATHED
STAINLESS
ELEMENTS

READY-READ
TEMPERATURE
INDICATOR



SIDE VIEW

BLUE M POWER-O-MATIC TO SOLID-STATE
PROPORTIONING CONTROL SYSTEM
AND AMBIENT TEMPERATURE
COMPENSATION WITH MAX-SET
OVERTEMPERATURE PROTECTION



FRONT VIEW

READY-READ TEMPERATURE INDICATOR— $3\frac{1}{2}$ " diameter. Stainless sensing bulb. Dual scale in C. and F.

OPERATION

Set control for desired temperature. Automatic, self-timing electromagnet below bottom non-magnetic wall, periodically pulsates perforated agitator plate through upward and downward movement. D.C. electromagnet energized and de-energized by "packaged power supply". Alloy leaf springs attached to agitator plate allow return when magnet is de-energized. Multi-perforations in agitator plate provide complete, gentle agitation and circulation throughout liquid mass, irrespective of how heavily bath is loaded.

GENERAL SPECIFICATIONS

Model Number	Inside Dimensions Inches (Cm.)			Overall Dimensions Inches (Cm.)			Total KVA	*Voltage 60 Hz. A.C. 1 Phase	Approx. Gals. (L.)
	L.	W.	D.	L.	W.	D.			
MWR-1155C-2	18 (45)	18 (45)	15 (38)	32 (80)	25 (63)	24 (61)	4.3	240 V.	23 (87)
MWR-1165C-2	36 (90)	18 (45)	9 $\frac{1}{2}$ (24)	50 (127)	25 (63)	18 (45)	6.0	240 V.	31 (117)

*Units operate reliably on 208 V. service. A 25% reduction in element power will result.

All wiring complete and enclosed to meet N.E. Code, as amended.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: FLOOR STANDS, REMOVABLE SOLID GABLE COVER WITH HANDLE, UCON FLUID, AUTOMATIC PROGRAM TIMERS.

SEND FOR ADDITIONAL INFORMATION AND ALL PRICES

BLUE M EQUIPMENT

A SALES AND SERVICE BRANCH OF
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New York, Elmsford 10523
New York, Syracuse 13206

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Texas, Garland 75040
Washington, Seattle 98108

**BLUE M**engineered
products in**ACTION****OPERATING AND CONTROL
CHARACTERISTICS****TEMPERATURE RANGE**

To +100°C. (+212°F.)

CONTROL ACCURACY: $\pm 0.5^{\circ}\text{C}$.**SETABILITY:** $\pm 1.0^{\circ}\text{C}$.**REPEATABILITY:** $\pm 0.5^{\circ}\text{C}$.**TYPICAL LIQUID UNIFORMITY**At +90°C.: $\pm 0.5^{\circ}\text{C}$.**BLUE M CERTIFICATION**

All tests conducted with no load, and stabilized bath under normal conditions of voltage and ambient. When unusual line voltages, ambients, and severe loads exist, please contact local sales offices or factory for recommendations.

BLUE M GUARANTEE

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operating requirements.

APPLICATION:

How to be assured of constant, uniform liquid temperature in an extra-deep bath of large volume and of unusual reliability.

SOLUTION:**BLUE M CONSTANT TEMPERATURE****WATER BATHS**

with **POWER-O-MATIC 60** ^{PATENTED} **Saturable Reactor Proportioning Control System.**

The patented POWER-O-MATIC 60 Saturable Reactor Proportioning Control System combined with the newly designed solid-state MAGNI-WHIRL agitation system makes these extra-deep baths suitable for the most critical needs. The built-in MAGNI-WHIRL agitation system replaces the usual stirrers or circulating methods . . . gently and automatically agitates the entire liquid volume equally to provide a temperature uniformity to $\pm 0.5^{\circ}\text{C}$. at any point from 5°C . above ambient to $+100^{\circ}\text{C}$. POWER-O-MATIC 60 Control System assures unmatched control reliability, accuracy and uniformity.

Vastly improved MAGNI-WHIRL system provides faster agitation, greater dependability, longer life, less maintenance. Timing and power relays are eliminated in agitation system . . . operation is silent . . . agitator pulse rate is variable . . . fluid directional flow is improved . . . normal variations in line voltage can be ignored . . . special ambient temperature compensation built-in.

Other outstanding features of these baths include a removable stainless element assembly for easy tank cleaning . . . recessed control panel . . . push-button safety reset switch to protect magnet and D.C. power supply . . . external means to compensate for line voltage variations—providing unequalled operating performance and convenience. No moving parts—no repairs, oiling or adjustments. 100% accessible and usable working area. MAX-SET overtemperature protection, now standard, safeguards workload and equipment.

A wide variety of other sizes and ranges for both water and oil liquids—with or without refrigeration—is also available. Write for details.

GENERAL SPECIFICATIONS**CONTROL SYSTEM**

POWER-O-MATIC 60 Saturable Reactor
Proportioning Control System.

MEMORY RING® Temperature Calibrating Dial.

DIAL POINTER LOCK

MAX-SET™ OVERTEMPERATURE
PROTECTION

MAIN CIRCUIT BREAKER

PILOT LAMPS (2)

NEW SOLID-STATE PACKAGED POWER SUPPLY—no timing relays—reliable and trouble-free. Magnet coil and power supply unit protected by KLIXON® bi-metal thermostat; touch on button plunger repositions protector for instantaneous resumption of normal operation.

NEW BUILT-IN AMBIENT TEMPERATURE COMPENSATION—automatically keeps liquid temperature at set point despite extreme fluctuations in ambient temperature. Assures performance to meet the most critical requirements throughout the day or night, winter or summer.

CONSTRUCTION

HOUSING—double wall type. Water chamber and outer jacket type 304, 18-8 stainless. All edges and joints heli-arc welded and passivated.

INSULATION—Asbestocel around water chamber.

ELEMENTS—removable. Sheath design, tubular type 316 stainless with "cold end" terminals. No welded fittings to receive elements.

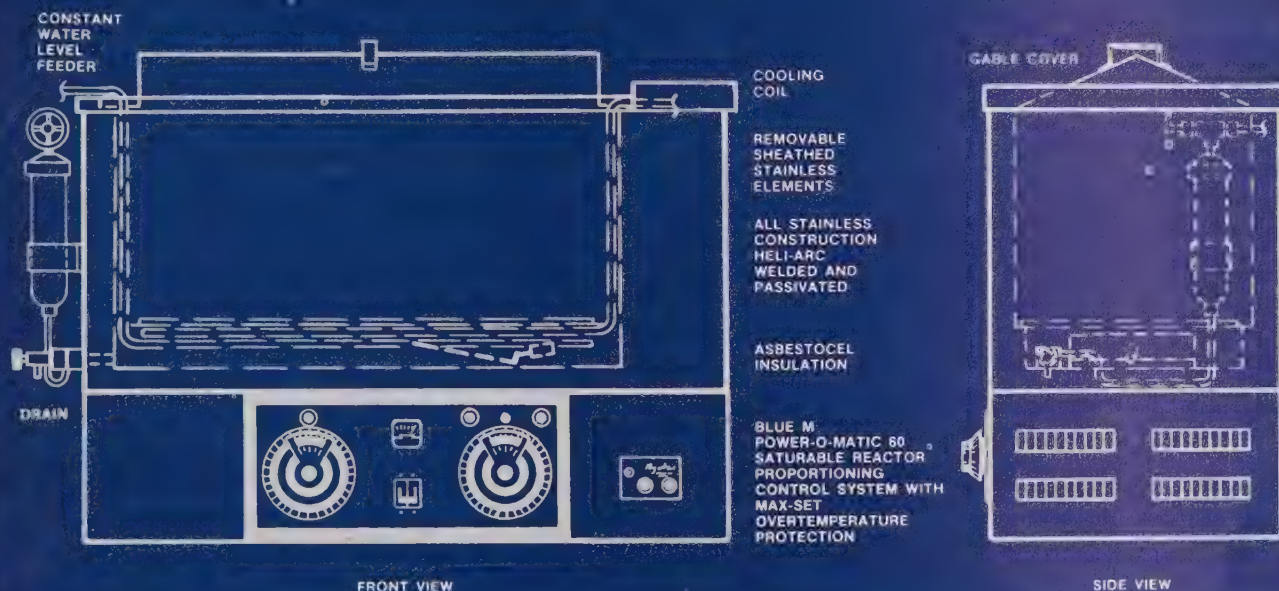
DRAIN—solid brass, nickel-plated.

THERMOMETER—mercury in glass.

**EQUIPMENT COVERED BY
OUR
EXCLUSIVE**

PARTS
WARRANTY
and
REPLACEMENT
SERVICE
PROGRAM

**BLUE M**



GABLE COVER—stainless, removable, with handle.

CONSTANT WATER LEVEL FEEDER—automatically maintains liquid at desired level regardless of temperature or test duration.

COOLING COIL—nickel-plated copper.

OPERATION

Set control for desired temperature. Automatic, self-timing electromagnet below bottom non-magnetic wall, periodically pulsates counterweighted rocker agitator plate. Variable, timed rocking motion of agitator provides complete, gentle, quiet agitation and circulation throughout entire liquid mass, despite heavy bath loading. D.C. electro-magnet energized and de-energized by a solid-state D.C. "packaged power supply" consisting of a Resistor-Capacitor network coupled into a unijunction transistor driving an SCR. External means of compensation for line voltage variations is provided.

GENERAL SPECIFICATIONS

Model Number	Inside Dimensions Inches (Cm.)			Overall Dimensions Inches (Cm.)			Total KVA	Voltage 60 Hz. A.C. 1 Phase	Approx. Gals. (L.)
	L.	W.	D.	L.	W.	D.			
MWR-1140BX	36	18	16	43	20½	28	4.6	208 V.	45
MWR-1140CX	(90)	(45)	(40)	(109)	(52)	(70)		240 V.	(170)

All wiring complete and enclosed to meet N.E. Code, as amended.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: AUTOMATIC SHUT-OFF TIMER, AND EXTRA THERMOMETERS.

SEND FOR ADDITIONAL INFORMATION AND ALL PRICES

BLUE M EQUIPMENT

A SALES AND SERVICE BRANCH OF
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New York, Elmsford 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

OPERATING AND CONTROL CHARACTERISTICS
(With Cover)

TEMPERATURE RANGE

+5°C. above ambient to +100°C.
(+212°F.)

RUN-UP TIME (No Load)

To +90°C. (Small size):

Approx. 1¼ hr.

To +90°C. (Large size):

Approx. 3¾ hr.

CONTROL ACCURACY: $\pm 0.5^{\circ}\text{C}$.

SETABILITY: $\pm 1.0^{\circ}\text{C}$.

TYPICAL LIQUID UNIFORMITY

At +65°C.: $\pm 0.7^{\circ}\text{C}$.

TEMPERATURE DRIFT

Over 24-hr. period: $\pm 0.5^{\circ}\text{C}$.

BLUE M CERTIFICATION

All tests conducted with no load, and stabilized bath under normal conditions of voltage and ambient. When unusual line voltages, ambients, and severe loads exist, please contact local sales offices or factory for recommendations.

BLUE M GUARANTEE

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operating requirements.

APPLICATION:

How to test/process in water held at above-ambient temperatures uniformly and reliably when fast run-up is required.

SOLUTION:

**BLUE M HIGH POWERED
CONSTANT TEMPERATURE WATER BATHS**



with Automatic Dual Microtrol Control, Constant Water Level Feeder, and Built-In Overtemperature Protection.

The unusually high K.W. rating of these MAGNI-WHIRL Baths has enabled Blue M to offer the test/processing specialist two proven units with unusually efficient, fast temperature run-up capabilities. Supplementing this short-test advantage is a constant water level feeder which automatically maintains the liquid level as desired—a valuable feature when the bath is to be operated at high temperatures and unattended over long periods. These combined features make these baths more convenient for many applications with the Dual Microtrol Control maintaining temperatures within $\pm 0.5^{\circ}$ or better throughout the range. Built-in overtemperature protection safeguards equipment and workload at all times.

MAGNI-WHIRL system replaces the usual stirrers or circulating methods . . . gently and automatically agitates the entire liquid volume equally for unmatched temperature uniformity. All baths are heli-arc welded to form a tight, leak-proof interior. Welds passivated. A solid stainless steel removable gable cover is standard. A drain cock is provided for convenient draining.

Vastly improved MAGNI-WHIRL system provides faster agitation, greater dependability, longer life, less maintenance. Timing and power relays are eliminated in agitator system . . . operation is silent . . . agitator pulse rate is variable . . . fluid directional flow is improved . . . normal variations in line voltage can be ignored. New solid-state EverCycle Switching Circuit uses SCR with transient suppression to control high wattage heating elements with very low current through the microswitches. Eliminates relays and moving parts . . . extends microswitch life . . . greatly improves reliability.

Other outstanding features of these baths include a removable stainless element assembly for easy tank cleaning . . . recessed control panel . . . push-button safety reset switch to protect magnet and D.C. power supply . . . external means to compensate for line voltage variations—providing unequalled operating performance and convenience. No moving parts—no repairs, oiling or adjustments.

GENERAL SPECIFICATIONS

CONTROL SYSTEM

DUAL MICROTROL—hydraulic type with dual microswitches. Totally enclosed contacts, U.L. Listed. Automatically selects and repeats any two consistently used temperatures within the range.

MEMORY RING® Temperature Calibrating Dial

BUILT-IN OVERTEMPERATURE PROTECTION

SOLID-STATE PACKAGED POWER SUPPLY—no timing relays—reliable and trouble-free. Magnet coil and power supply unit protected by KLIXON® bi-metal thermostat; touch on button plunger repositions protector for instantaneous resumption of normal operation.

MAIN SWITCH

PILOT LAMPS (2)

CONSTRUCTION

HOUSING—double wall type. Water chamber and outer jacket type 304, 18-8 stainless. All edges and joints heli-arc welded and passivated.

INSULATION—Asbestocel around water chamber.

ELEMENTS—removable. Sheath design, tubular type 316 stainless with "cold end" terminals. No welded fittings to receive elements which are electropolished.

DRAIN—solid brass, nickel-plated.

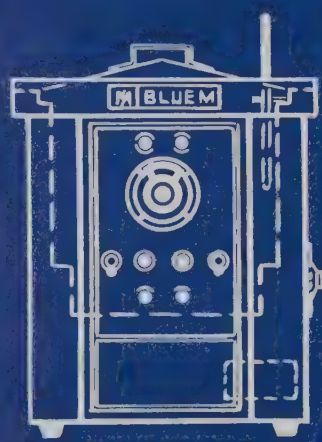
THERMOMETER—mercury in glass.

RACK—stainless steel. Reversible.

REMOVABLE SOLID GABLE COVER (with handle)

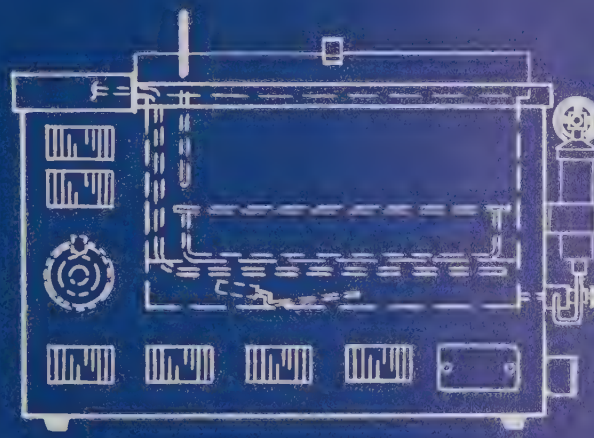
CONSTANT WATER LEVEL FEEDER—automatically





FRONT VIEW

THERMOMETER
ALL STAINLESS CONSTRUCTION HELI-ARC WELDED
BLUE M DUAL MICROTROL
OVERTEMPERATURE PROTECTION
ASBESTOCEL INSULATION
BLUE M PATENTED MAGNI-WHIRL MAGNETIC PUMPING ACTION—NO MOTORS



SIDE VIEW

REMOVABLE SOLID GABLE COVER
REMOVABLE SHEATHED STAINLESS ELEMENTS
DRAIN
CONSTANT WATER LEVEL FEEDER

maintains liquid at desired level—important when bath is operated over extended periods unattended.

OPERATION

Set control for desired temperature (Dual Microtrol permits setting of two most frequently used temperatures). Automatic, self-timing electromagnet below bottom non-magnetic wall, periodically pulsates counterweighted rocker agitator plate. Variable, timed rocking motion of agitator provides complete, gentle, quiet agitation and circulation throughout entire liquid mass, despite heavy bath loading. D.C. electro-magnet energized and de-energized by a solid-state D.C. "packaged power supply" consisting of a Resistor-Capacitor network coupled into a unijunction transistor driving an SCR. External means of compensation for line voltage variations is provided.

GENERAL SPECIFICATIONS

Model Number	Full Working Space Inches (Cm.)			Overall Dimensions Inches (Cm.)			Approx. Capacity Gals. (L.)	Total KVA	Voltage 50/60 Hz. A.C. Single Phase
	L.	W.	D.	L.	W.	D.			
MW-1120C-1HP	18 (45)	12 (31)	7 1/2 (19)	27 (68)	14 (35)	16 (40)	8.6 (31)	3.2	*240 V.
MW-1140C-1HP	36 (90)	18 (45)	9 1/2 (24)	45 (114)	20 (51)	19 (48)	31 (117)	5.5	*240 V

*These models will operate reliably when connected to 208 volt service. A 25% reduction in element power will result. Larger model employs two SCR switching devices.

All wiring complete and enclosed to meet N.E. Code, as amended. Terminal box.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: CONCENTRIC RING COVER WITH CONCENTRIC RING SETS, NICKEL-PLATED COPPER COOLING COIL AND EXTRA THERMOMETER.

SEND FOR ADDITIONAL INFORMATION AND ALL PRICES

BLUE M EQUIPMENT

A SALES AND SERVICE BRANCH OF
 BLUE M EQUIPMENT COMPANY

Corporate Headquarters: Blue Island, Illinois 60406

Arizona, Scottsdale 85251
 California, El Monte 91731
 California, Sunnyvale 94086
 Florida, Orlando 32789
 Georgia, Atlanta 30341

Illinois, Blue Island 60406
 Massachusetts, Framingham 01701
 Michigan, Allen Park 48101
 New York, Elmsford 10523
 New York, Syracuse 13206

North Carolina, Charlotte 28210
 Ohio, Cincinnati 45237
 Pennsylvania, Ardmore 19003
 Texas, Garland 75040
 Washington, Seattle 98108

APPLICATION: How to accurately and reliably test components or assemblies in liquids of different temperatures with maximum convenience and efficiency.

OPERATING AND CONTROL CHARACTERISTICS

TEMPERATURE RANGE
 0°C. to +100°C. (+212°F.)

CONTROL ACCURACY: $\pm 0.5^{\circ}\text{C}$.

SETABILITY: $\pm 1.0^{\circ}\text{C}$.

REPEATABILITY: $\pm 0.5^{\circ}\text{C}$.

TYPICAL LIQUID UNIFORMITY
 At $+65^{\circ}\text{C}$.: $\pm 0.25^{\circ}\text{C}$.

BLUE M CERTIFICATION

All tests conducted with no load, and stabilized bath under normal conditions of voltage and ambient. When unusual line voltages, ambients, and severe loads exist, please contact local sales offices or factory for recommendations.

BLUE M GUARANTEE

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operating requirements.

SOLUTION: BLUE M MULTI-BATH CALIBRATION TEST STANDS

This four-bath calibrating installation is typical of a variety of different testing facilities Blue M provides to meet exacting testing requirements. Each bath in this example is regulated by its own Blue M Dual Microtrol working in conjunction with special independent top-mounted agitators to provide temperature constancy of $\pm 0.2^{\circ}\text{C}$. or better throughout the broad 0°C. to $+100^{\circ}\text{C}$. range of the chambers.

Again, typically, such an installation can be used for testing such instrumentation as thermostats. The baths can be factory-calibrated individually to any desired temperature in their range. Depending on the application, temperature differences between each bath may be only a few degrees— 50°C . and 53°C ., for example, or much wider— 60°C . and 90°C .

From this it is obvious that every installation can be made to read exactly on the user's needs. Also, fewer baths—two or three—can be utilized, or more—as many as may be needed can be engineered into a single, efficient facility. The units shown here are water baths. Blue M can include baths for use with oil for temperatures to $+260^{\circ}\text{C}$., and combine them with refrigerated baths for provide a facility temperature span down to 0°C. Naturally, size can be varied also so that larger or smaller capacities can be included, and a variety of control systems—including the patented POWER-O-MATIC 60® Saturable Reactor Proportioning Control for truly critical applications—are available, and the patented MAGNI-WHIRL agitation system can be included. In short, Blue M is equipped to engineer, build and deliver the exact bath installation your test/process requires. And it will include the same quality design and construction features typified by those shown below.

GENERAL SPECIFICATIONS

CONTROL SYSTEM FOR EACH BATH

DUAL MICROTROL—hydraulic type with dual micro-switches. Totally enclosed contacts, U.L. Listed. Automatically selects and repeats any two consistently used temperatures within the range.

MEMORY RING® Temperature Calibrating Dial.

MECHANICAL REFRIGERATION SYSTEMS—four independently operating systems, one for each bath, consisting of a Copeland semi-hermetic, non-cycling Refrigerant 12 compressor, fan, air-cooled condensor and nickel-plated copper cooling coils. Compressor runs continuously when operating below ambient. Conveniently installed under baths.

MAIN SWITCH

PILOT LAMPS

CONSTRUCTION

HOUSING—double wall type. Water chamber and outer jacket type 304, 18-8 stainless. All edges and joints heli-arc welded and passivated.

INSULATION—Asbestocel around water chamber.

ELEMENTS—removable. Sheath design, tubular, type 316 stainless with "cold end" terminals. No welded fittings to receive elements.

DRAIN—solid brass, nickel-plated.

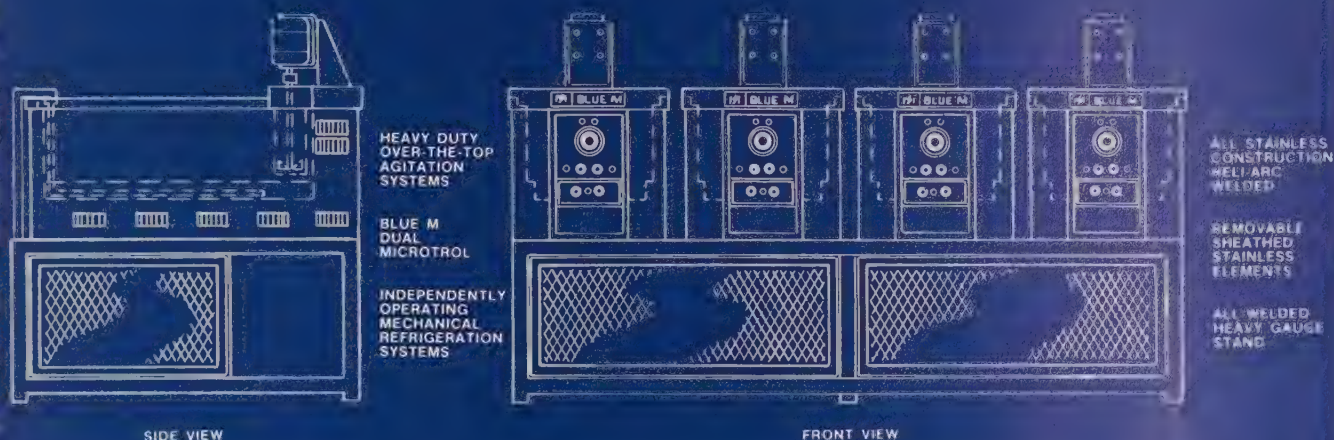
THERMOMETER—mercury in glass.

OVER-THE-TOP AGITATION—quality 1/6 H.P. top mounted motor with stainless steel shaft and impeller provides proper agitation for excellent uniformity.

EQUIPMENT COVERED BY OUR EXCLUSIVE

PARTS
 WARRANTY
 and
 REPLACEMENT
 SERVICE
 PROGRAM





STAND—all-welded hot-rolled steel angles with heavy gauge enclosure panels elevates baths to convenient working height and houses mechanical refrigeration system. Finished in light blue epoxy enamel.

OPERATION

Set control for desired temperature (Dual Microtrol permits setting of two most frequently used temperatures). Agitation system recirculates liquid constantly and uniformly throughout tank.

For sub-ambient operation, turn on main switch and compressor switch and set control. Compressor runs continuously. Temperature is maintained by cycling of heaters since heat input is greater than cooling capacity of compressor.

Model Number	*Inside Dimensions Inches (Cm.)			**Overall Dimensions Inches (Cm.)			**Total KVA	Voltage 60 Hz. A.C. 1 Phase	**Approx. Gals. (L.)
	L.	W.	D.	L.	W.	D.			
SPB-105B	34½ (87)	18 (45)	9 (22)	45 (114)	88 (223)	50 (126)	15 0	±208V	124 (470)
SPB-105C	34½ (87)	18 (45)	9 (22)	45 (114)	88 (223)	50 (126)	15 0	240V	124 (470)

*Per Bath

**All 4 baths

†Includes autoformer for 208V./1 Ph. operation.

All wiring complete and enclosed to meet N.E. Code, as amended.

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Washington, Seattle 98108

APPLICATION: How to test in a liquid medium at very low and at high temperatures with maximum convenience and reliability.

OPERATING AND CONTROL CHARACTERISTICS

(REFRIGERATED BATH)

TEMPERATURE RANGE
+20°C. to +204°C. (+400°F.)

RUN UP TIME

+25°C. to +90°C.: 90 minutes

CONTROL ACCURACY: $\pm 0.5^\circ\text{C}$.

SETABILITY: $\pm 1.0^\circ\text{C}$.

REPEATABILITY: $\pm 0.5^\circ\text{C}$.

TYPICAL TEMPERATURE UNIFORMITY

At +65°C.: $\pm 0.2^\circ\text{C}$.

TEMPERATURE DRIFT

Over 24 hr. period: $\pm \frac{1}{2}^\circ\text{C}$.

(LN₂ BATH)

TEMPERATURE RANGE
-70°C. to +100°C. (+212°F.)

TYPICAL TEMPERATURE UNIFORMITY

At -65°C.: $\pm 0.2^\circ\text{C}$.

INDICATION ACCURACY

$\pm 1\%$ of scale

CONTROL TOLERANCE

$\pm 2.0^\circ\text{C}$.

SOLUTION:

BLUE M DUAL LN₂ AND REFRIGERATED BATHS

with Independent  **Saturable Reactor**

Proportioning Control System and Solid-State Indicating Control Potentiometer.

Extremes of cold and temperatures well above ambient are duplicated and held to fine tolerances in these unique baths. A compact, convenient and efficient installation for precision-testing of temperature-sensitive parts and components, these baths each have their own control system. The mechanically refrigerated bath, which has a temperature range from +20°C. to +204°C., is equipped with the patented POWER-O-MATIC 60 Control. The second bath employs liquid nitrogen and is equipped with a solid-state indicating control potentiometer and has a range from -70°C. to +100°C. Both baths also feature appropriate overtemperature protection devices.

Independently operated heavy-duty motors and matched stirrers provide a uniformity of $\pm 0.2^\circ\text{C}$. throughout the liquid volume in each bath 2" from each of the walls, top and element. As shown, baths are mounted on a steel frame to form a single, efficient testing facility. Casters enable them to be moved easily to any desired location. The baths can also be separated if required.

GENERAL SPECIFICATIONS

CONTROL SYSTEM

(REFRIGERATED BATH)

POWER-O-MATIC 60 Saturable Reactor
Proportioning Control System.

BUILT-IN AMBIENT TEMPERATURE COMPENSATION

MAX-SET™ OVERTEMPERATURE PROTECTION

MEMORY RING® Temperature Calibrating Dial.

DIAL POINTER LOCK

MECHANICAL REFRIGERATION SYSTEM—Cope-land semi-hermetic, non-cycling Refrigerant 12 compressor, runs continuously when operating below ambient.

COMPRESSOR SWITCH • VOLTMETER

MAIN CIRCUIT BREAKER • PILOT LIGHTS (3)

(LN₂ BATH)

SOLID-STATE INDICATING CONTROL POTENTIOMETER—fully automatic, with built-in time proportioning. Illuminated direct read-out dial with 8" scale provides setting accuracy to within 0.5% of

scale. Centigrade standard; Fahrenheit available on special order.

BUILT-IN OVERTEMPERATURE PROTECTION—similar solid-state instrument complements control, provides positive protection for workload and unit. Features MAX-SET time-delay circuitry.

SOLENOID VALVE—meters LN₂.

COOLING COIL • HEAT SWITCH • COLD SWITCH

MAIN CIRCUIT BREAKER • PILOT LIGHTS (3)

CONSTRUCTION

(BOTH BATHS)

HOUSING—double wall type. Interior and exterior polished type 304, 18-8 stainless. All edges and joints heli-arc welded and passivated.

INSULATION—Fiberglas.

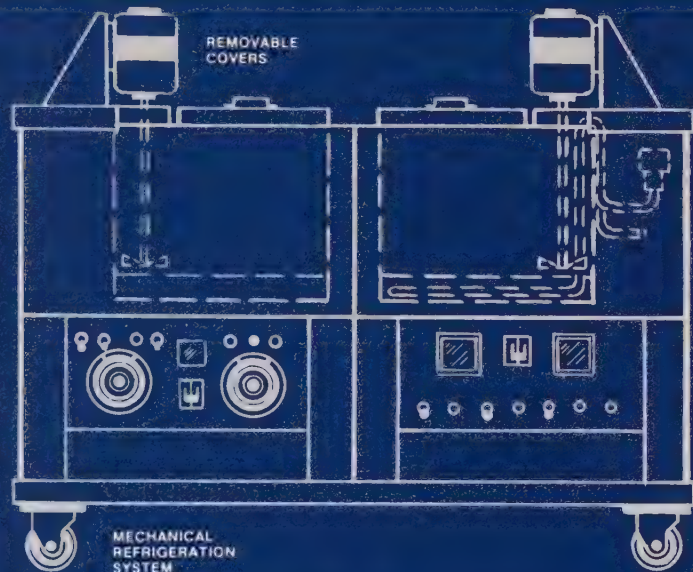
LOAD RACK—stainless steel rod type.

ELEMENTS—removable. Sheathed design, tubular, type 316 stainless with "cold end" terminals. No welded fitting to receive elements.

EQUIPMENT COVERED BY OUR EXCLUSIVE

PARTS WARRANTY and REPLACEMENT SERVICE PROGRAM





FRONT VIEW

HEAVY-DUTY
MOTOR/STIRRER
ASSEMBLIES

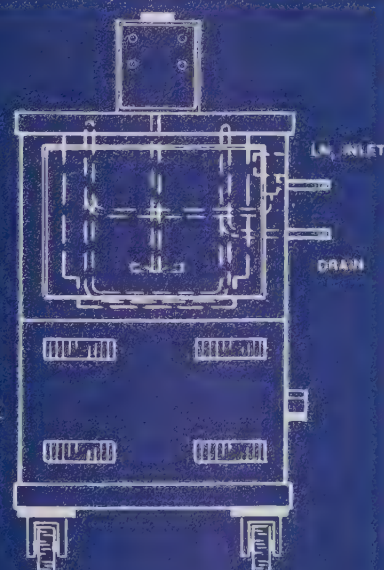
REMOVABLE
OVER-THE-TOP
SHEATHED STAINLESS
ELEMENTS

ALL STAINLESS
CONSTRUCTION
HELI-ARC WELDED

SOLID-STATE
INDICATING CONTROL
POTENTIOMETER AND
OVERTEMPERATURE
PROTECTION

BLUE M
POWER-O-MATIC 60
SATURABLE REACTOR
PROPORTIONING CONTROL
SYSTEM WITH
MAX-SET
OVERTEMPERATURE
PROTECTION AND
BUILT-IN AMBIENT
TEMPERATURE
COMPENSATION

CASTERS



SIDE VIEW

MOTOR/STIRRER ASSEMBLY—quality, heavy-duty motor powers carefully matched stainless stirrer system for uniform recirculation of entire liquid volume.

GLASS THERMOMETER

DRAIN • CASTERS

OPERATION

POWER-O-MATIC 60 BATH

Set control for desired temperature. Agitation system recirculates liquid constantly and uniformly throughout tank. POWER-O-MATIC 60 Control system automatically maintains liquid temperature to close tolerances.

Liquid Nitrogen Bath

For sub-ambient operation, set control for desired temperature and solenoid valve meters LN₂ to cooling coil as required. In heating, elements transmit heat directly to liquid. Solid-state control with built-in time proportioning, automatically regulates both heating and cooling with a fine degree of accuracy while agitation system recirculates liquid constantly and uniformly throughout tank.

GENERAL SPECIFICATIONS

Model Number	Inside Dimensions of Each Bath Inches (Cm.)			Overall Dimensions of Both Baths Inches (Cm.)			Total KVA Both Baths	Voltage 60 Hz. A.C. 1 Phase	Approx. Gals. (L.) Per Bath
	L.	W.	D.	W.	D.	H.			
WED-100LNC-1	12 (31)	18 (45)	14 (35)	61 (154)	31 (78)	53 (133)	6.9	240 V.	17 (64)

All wiring complete and enclosed to meet N.E. Code, as amended.

BLUE M CERTIFICATION

All tests conducted with no load, and stabilized bath under normal conditions of voltage and ambient. When unusual line voltages, ambients, and severe loads exist, please contact local sales offices or factory for recommendations.

BLUE M GUARANTEE

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operating requirements.

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New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

APPLICATION:

How to easily meet the most severe in-house test specifications or test to MIL. STD. 883A, Method 1011.1, Conditions A to F with baths of unequalled performance characteristics.

OPERATING AND CONTROL CHARACTERISTICS

TEMPERATURE RANGES

Ambient to +204°C. (+400°F.)

Ambient to -35°C. (-31°F.)

0°C. to -75°C. (-103°F.)

0°C. to -100°C. (-148°F.)

CONTROL AND UNIFORMITY

±0.25°C. throughout all ranges

BLUE M CERTIFICATION

All tests conducted with no load, and stabilized bath under normal conditions of voltage and ambient. When unusual line voltages, ambients, and severe loads exist, please contact local sales offices or factory for recommendations.

BLUE M GUARANTEE

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operating requirements.

SOLUTION:

BLUE M CONSTANT TEMPERATURE BATHS

with Solid-State Proportioning Control.

These new Blue M Versa-Whirl Baths are the most advanced modules of their kind ever developed. Ideal for precision testing of electronic components, instrument calibration and similar applications to rigid in-house requirements, the units also meet the demanding specification of MIL. STD. 883A, Method 1011.1, Conditions A to F. Applicable sections of this Specification are reproduced on pages 192-196.

There are four models, each with a distinct temperature range as shown to the left. This enables the exact unit needed to be selected, and avoids the prohibitively high cost of an "all-in-one" design. This also enables those testing to MIL. STD. 883 to select just the bath designed to fit that Condition of the Specification to be met. See the Unit Selection Guide on the next page.

Temperature is regulated by proven solid-state time proportioning control. A precision dial type stem thermometer provides indication of actual chamber conditions in relation to setpoint. Controller cycles constantly at a rate preset by the operator, resulting in virtual straight-line performance. Liquid is recirculated by a uniquely efficient system consisting of an externally mounted, air-driven 1/6 H.P. motor with a stainless steel extended shaft and impeller. Finger-tip adjustment varies speed from 100 to 6000 R.P.M. Combined with the solid-state instrumentation, this agitation system provides the remarkable ±0.25°C. uniformity possible in all models.

All baths in this series are similar in design, construction and appearance, permitting side-by-side installation. This facilitates convenient transfer of components from one bath to another as required. Similar models with an automatic transfer mechanism are described on the following pages.

NOTE: For other Blue M equipment designed specifically for thermal shock test work see catalog pages 66-69.

GENERAL SPECIFICATIONS

CONTROL SYSTEM

SOLID-STATE NULL INDICATING CONTROL POTENTIOMETER—null balance control powered by Zener Diode constant voltage source. Setpoint repeatability ±½°C.

MAIN SWITCH

PILOT LIGHT

CONSTRUCTION

HOUSING—all welded heavy gauge cold rolled steel, reinforced. All mechanical equipment, such as refrigeration equipment, in well ventilated compartment under bath proper. Removable access panels simplify inspection.

INTERIOR—type 304-2B, 18-8, heavy gauge stainless. All seams heli-arc welded liquid tight and passivated.

EXTERIOR—light blue-grey epoxy enamel finish. Attractive, easy to keep clean.

OVER THE TOP AGITATION—quality variable speed air-operated motor with stainless steel shaft and impeller provides proper agitation for excellent uniformity.

INSULATION—5" thick rigid polyurethane foam.

DRAIN—½" stainless with shut-off valve.

REMOVABLE COVER—overlaps entire work chamber with flange that fits inside work area for snug closure. Two handles. Rugged construction matches bath.

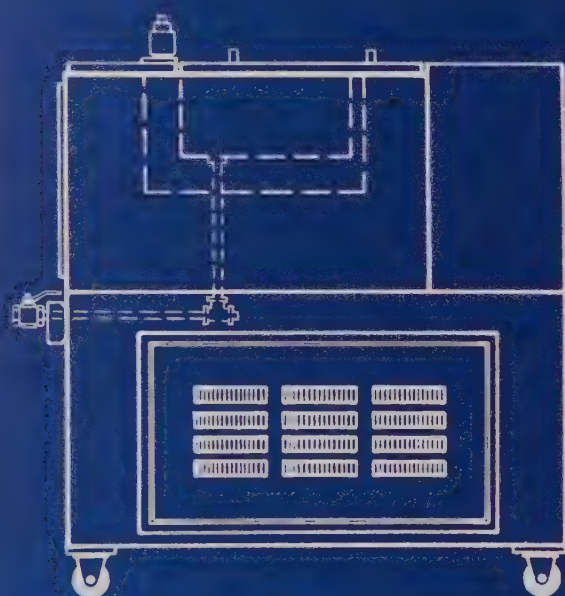
EQUIPMENT COVERED BY OUR EXCLUSIVE

PARTS
WARRANTY
and
REPLACEMENT
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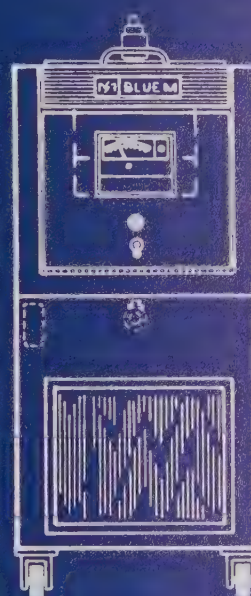


A BLUE M

STANDARD



SIDE VIEW

OVER-THE-TOP
AGITATION SYSTEMREMOVABLE
COVERPOLYURETHANE
INSULATIONDRAIN WITH
SHUT-OFF
VALVEVERSA-KOLD
SINGLE STAGE
OR CASCADE
MECHANICAL
REFRIGERATION
SYSTEMSOLID-STATE
CONTROL
POTENTIOMETERCASTERS
(OPTIONAL)

FRONT VIEW

UNIT SELECTION GUIDE, MIL. STD. 883A, METHOD 1011.1

Bath Temp. Range	Thermal Stock Test Condition						Refrigeration		Amps
	A	B	C	D	E	F	Type System	Condenser Cooling	
AMBIENT To +204°C.	+100°C. +5 -0	+125°C. +5 -0	+150°C. +5 -0	+200°C. +5 -0	+150°C. +5 -0	+200°C. +5 -0	None	None	13.0
AMBIENT To -35°C.	0°C. +0 -5	N.A.	N.A.	N.A.	N.A.	N.A.	Single Stage	Air	6.0
0°C. to -75°C.	0°C. +0 -5	-55°C. +0 -5	-65°C. +0 -5	-65°C. +0 -5	N.A.	N.A.	Cascade	Air	11.0
0°C. to -100°C.	0°C. +0 -5	-55°C. +0 -5	-65°C. +0 -5	-65°C. +0 -5	N.A.	N.A.	Liquid Nitrogen	None	1.0

LEG LEVELERS—heavy duty type to insure proper bath installation on even rough surfaces. Ball bearing swivel type casters for mobility optional.

TEMPERATURE INDICATOR—dial type stem thermometer, with range to suit bath. Calibrated in °C.

MECHANICAL REFRIGERATION (ON APPLICABLE MODELS)—exclusive Blue M single stage or cascade type Versa-Kold Refrigeration Systems. Features non-cycling Copeland semi-hermetic compressors. Quality-built to insure rapid pull-down rates with long-lived, economical operation.

OPERATION

Set control for desired temperature. Agitation system recirculates liquid constantly and uniformly throughout tank. Control and uniformity are automatically maintained at $\pm 0.25^\circ\text{C}$. through liquid mass.

For proper application as to product loading, please submit your requirements to the factory. All models have a work space of 10" W. x 14" L. x 8" D. with a fluid depth of 7". Fluids suitable for this series of baths include *UCON, Methylene Chloride, Trichloroethylene, Trichloromonofluoromethane, Silicone fluids, and Fluorocarbon fluids. For recommended fluid for your particular application, please contact factory.
NOTE: Outside dimension of all models: 20 1/2" W. x 41" L. x 40" H. *Trade mark U.C.C. Co
NOTE: These baths are not suitable for use with water.

GENERAL SPECIFICATIONS

Model Number	Temperature Range	Inside Dimensions Inches (Cm.)			Total KVA	Voltage 60Hz. A.C. 1 Phase	Approx. Gals. (L).
		L.	W.	D.			
LTB-1-P200C	Amb. to +204°C.	14 (35)	10 (25)	8 (20)	2.1	240V.	7.0 (26)
LTB-1-M35C	Amb. to -35°C.				2.4	240V.	
LTB-1-M75C	0°C. to -75°C.				2.4	240V.	
LTB-1-M100A	0°C. to -100°C.				0.2	120V.	

All wiring complete and enclosed to meet NEMA standards.

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OPERATING AND CONTROL CHARACTERISTICS

TEMPERATURE RANGES

Ambient to +204°C. (+400°F.)
0°C. to -75°C. to (-103°F.)

CONTROL AND UNIFORMITY

±0.25°C. throughout both ranges.

BLUE M CERTIFICATION

All tests conducted with no load, and stabilized bath under normal conditions of voltage and ambient. When unusual line voltages, ambients, and severe loads exist, please contact local sales offices or factory for recommendations.

BLUE M GUARANTEE

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operating requirements.

APPLICATION:

How to automatically test to MIL. STD. 883A, Method 1011.1, Conditions A to D or meet severe in-house test specifications with an automated system with unmatched performance capabilities.

SOLUTION:

BLUE M *VERSA-Whip* CONSTANT TEMPERATURE BATHS

with Solid-State Proportioning Control and Automatic Load Transfer System

The advanced, fully automatic transfer system on these quality baths assures strict compliance to the specifications of MIL. STD. 883A, Method 1011.1, Conditions A to D while eliminating any chance of operator error. The specially designed transfer mechanism moves the test load in a removable basket from one bath to the other, with the appropriate dwell times and number of cycles required by the Specification all met automatically. Applicable sections of this Specification are reproduced on pages 192-196. Salient features of the transfer system include a timer which can be regulated to provide dwell times up to 60 minutes, and a counter which can be set to provide up to 80 cycles. A control switch enables the system to be operated manually. These design characteristics enable the system's operation to be tailored to meet virtually any in-house test specification, and to be quickly and easily altered to meet whatever new conditions may arise. Also, either of the baths proper can be utilized independently for test work whenever their particular temperature ranges are needed.

As indicated, one bath has a range from 0°C. to -75°C., the other a range from ambient to +204°C. Each bath is equipped with its own proven solid-state time proportioning control which cycles constantly at a rate preset by the operator. This results in virtual straight-line performance. Indication of actual chamber conditions in relation to control setpoint is provided by a precision dial type stem thermometer.

A uniquely efficient agitation system, consisting of an externally mounted, air-driven 1/6 H.P. motor with a stainless steel extended shaft and impeller, assures uniform liquid recirculation. Fingertip adjustment varies speed from 100 to 6000 R.P.M. This system—combined with the solid-state instrumentation—provides the remarkable ±0.25°C. uniformity possible in both baths.

NOTE: Other Blue M equipment for thermal shock test work are described on pages 66-69.

GENERAL SPECIFICATIONS

CONTROL SYSTEM

(Each Bath)

SOLID-STATE NULL INDICATING CONTROL POTENTIOMETER—null balance control powered by Zener Diode constant voltage source. Setpoint repeatability ±½°C.

MAIN SWITCH

PILOT LIGHT

AUTOMATIC TRANSFER MECHANISM

Designed specifically for this facility. Includes four-way solenoid valve and a pneumatic rotary actuator for moving workload from one bath to the other.

DWELL TIMER—easily adjusted to regulate individual dwell times up to 60 minutes.

CYCLE COUNTER—quickly set to automatically transfer the workload basket from one bath to another through any number of pre-set cycles up to 80. Counter and timer conveniently installed in control compartment which also houses appropriate indicator lights, activating switches, and a separate control switch for operating the system manually.

WORKLOAD BASKET—provides approximately 390-cubic-inch volume. Quickly and easily removed.

BATH CONSTRUCTION

HOUSING—all-welded heavy gauge cold-rolled steel, reinforced. All mechanical equipment, such as refrigeration equipment, in well ventilated compartment under bath proper. Removable access panels simplify inspection.

INTERIOR—type 304-2B, 18-8, heavy gauge stainless. All seams heli-arc welded liquid tight and passivated.

EXTERIOR—light blue-grey epoxy enamel finish. Attractive, easy to keep clean.

OVER THE TOP AGITATION—quality variable speed air-operated motor with stainless steel shaft and impeller provides proper agitation for excellent uniformity.

INSULATION—5" thick rigid polyurethane foam.

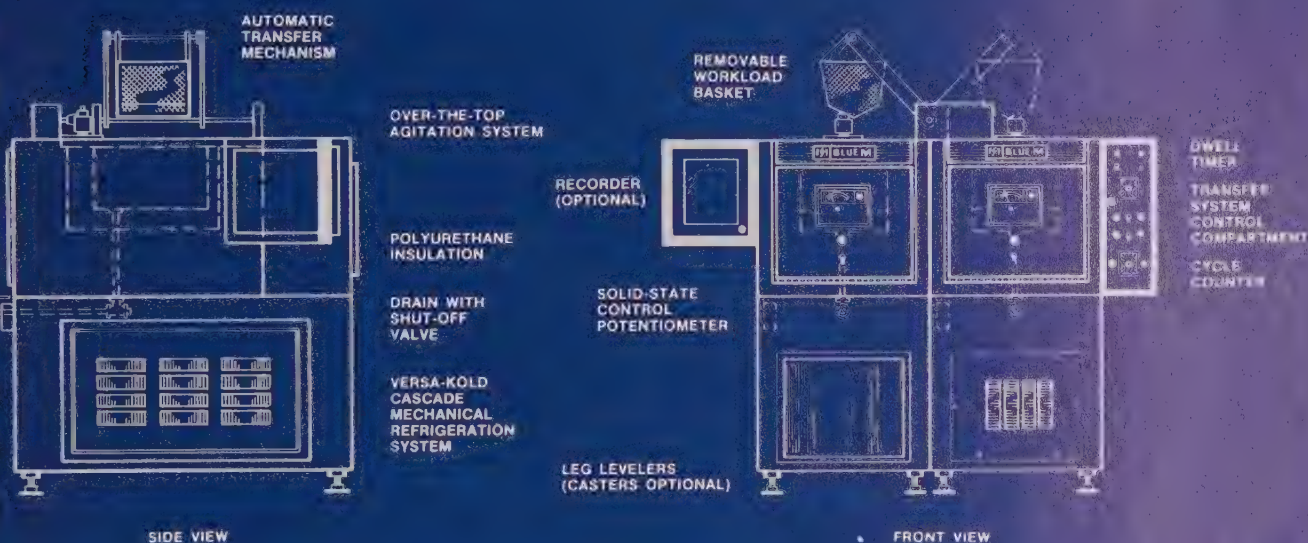
DRAIN—½" stainless with shut-off valve.

REMOVABLE COVER—overlaps entire work chamber with flange that fits inside work area for snug clo-

EQUIPMENT COVERED BY
OUR
EXCLUSIVE

PARTS
WARRANTY
and
REPLACEMENT
SERVICE
PROGRAM





GENERAL SPECIFICATIONS

Model Number	Inside Dimensions Inches (Cm.) Per Bath			Overall Dimensions Inches (Cm.) Facility			Total KVA	Voltage 60 Hz. A.C. 1 Phase	Approx. *Gals. (L.) (Per Bath)
	L.	W.	*D.	W.	D.	H.			
LTB-ATS-1	14 (35)	10 (25)	8 (20)	52 (132)	41 (104)	†41 (104)	4.0	240V.	7.0 (26)

*Fluid Depth: 7" (18).

†From floor to top of baths.

All wiring complete and enclosed to meet amended N.E. Code.

BATH TEMP. RANGE	THERMAL SHOCK TEST CONDITION			
	A	B	C	D
AMBIENT TO +204°C.	+100°C. +5 -0	+125°C. +5 -0	+150°C. +5 -0	+200°C. +5 0
0°C. TO -75°C	0°C. +0 -5	-55°C. +0 -5	-65°C. +0 -5	-65°C +0 -5

For proper application as to product loading, please submit your requirements to the factory.

Fluids suitable for this series of baths include *UCON, Methylene Chloride, Trichloroethylene, Trichloromonofluoromethane, Silicone fluids and Fluocarbon fluids. For recommended fluid for your particular application, please contact factory.

NOTE: These baths are not suitable for use with water.

*Trademark U.C.C. Co

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: CASTERS, RECORDERS AND EXTRA TRANSFER BASKETS.

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North Carolina, Charlotte 28210
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**BLUE M**engineered
products in**ACTION****APPLICATION:**

How to effectively chill liquids to as low as -23°C . anywhere with a mobile cooling instrument custom-engineered to your specifications.

OPERATING AND CONTROL CHARACTERISTICS**TEMPERATURE RANGE**

To -23°C . (-10°F .)

***CONTROL TOLERANCE:** $\pm 0.5^{\circ}\text{C}$.

***CAPACITY**

5,000 BTU/HR

*Performance is subject to a number of variables, including coil size and configuration. See charts on opposite page. All data based on a typical cylindrical coil, 7" O.D. and 19" H. Control tolerance shown based on standard cooling coil in a normal liquid cooling application having adequate agitation.

BLUE M GUARANTEE

When applications are factory approved, we **GUARANTEE** to supply unit(s) meeting your operating requirements.

SOLUTION:**BLUE M** *Constant-Flow*
Patented
PORTABLE COOLING UNITS

with Cooling Coils Custom-Designed to Individual Needs.

The 5000 BTU/HR capacity of these quality portable units make them an ideal means to chill liquids at any location. Typical applications include auxiliary cooling of parts or components, for direct chilling of liquids, for indirect or supplementary cooling, and general industrial/laboratory use.

Because the applications for these coolers are so diverse, the cooling coils are designed individually by Blue M to meet the particular requirements of the job. A few typical coil configurations are illustrated to indicate the wide range of possible shapes available. The coil best suited to your needs will be developed after a thorough application survey has been made by a Blue M Engineer. Coils are available in stainless steel or nickel-plated copper.

The heart of these units is Blue M's Constant-Flow Mechanical Refrigeration System housed in an attractive polished stainless steel cabinet with casters. Blue M Microtrol provides $\pm 0.5^{\circ}\text{C}$. control. Cooling coils are connected to the housing by 6 ft. long alloy flexible tubing encased in tough plastic. Flexibility permits coil placement as desired without moving compressor compartment.

GENERAL SPECIFICATIONS**CONTROL SYSTEM**

BLUE M MICROTROL (Controlling Thermostat)—offers operating sensitivity throughout entire range. When stainless steel coil is specified, a Type 316 stainless sensing bulb and capillary are supplied. A nickel-plated sensing bulb and capillary are supplied with nickel-plated copper coils.

MEMORY RING® Temperature Calibrating Dial.

DIAL POINTER LOCK

PILOT LIGHT

MAIN SWITCH

CONSTRUCTION

HOUSING—all-polished stainless steel with adequate cross ventilating areas to assure proper air circulation. Four ball bearing swivel casters.

CONSTANT-FLOW MECHANICAL REFRIGERATION—quality $\frac{3}{4}$ H.P. hermetic type single-stage Re-

frigerant 12 system. Thermostatic expansion valve serves as metering device. Exclusive hot gas bypass capacity control circuit provides maximum efficiency under all operating conditions. Air-cooling by separate heavy-duty motor driven fan prevents overheating. System operates continuously.

FLEXIBLE HOSES—6' long connect cooling coil and compressor. Alloy tubing encased in tough plastic sheath. Coil can be placed as desired without moving compressor compartment.

COOLING COILS—nickel-plated copper or stainless steel, in your choice of configuration. Quality built and thoroughly tested for leaks under pressure.

OPERATION

Set control for desired temperature. Refrigeration system automatically lowers temperature of liquid into which the cooling coil has been placed per the typical performance charts and specifications at right.

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REFRIGERANT 12
MECHANICAL
REFRIGERATION
SYSTEM

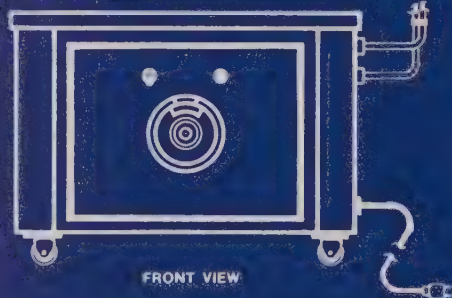
BLUE M
MICROTROL
CONTROL

SWIVEL
CASTERS

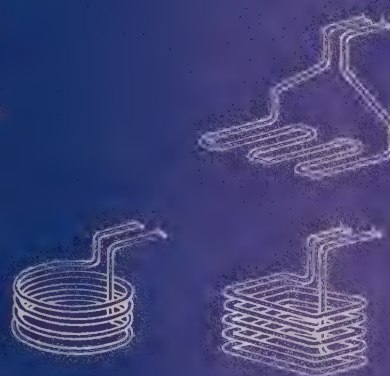
THERMO-EXPANSION
VALVE IN STAINLESS
HOUSING

6' LONG FLEXIBLE
ALLOY HOSES
ENCASED IN
PLASTIC

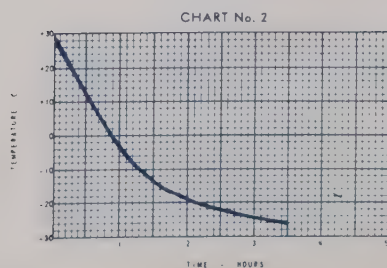
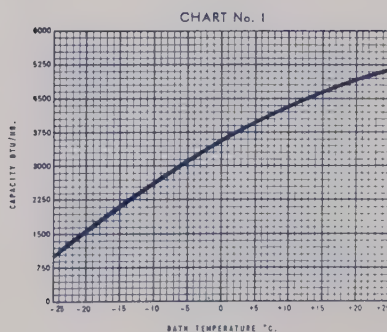
STAINLESS HOUSING



FRONT VIEW



TYPICAL CUSTOM COIL CONFIGURATIONS
(NICKEL-PLATED COPPER OR STAINLESS STEEL)



Top chart shows total refrigeration system capacity for each model at bath temperature indicated. To find net capacity or minimum temperature obtainable, subtract total heat gains of the application at desired bath temperature from above capacities.

Lower chart shows pull-down time in 12" x 12" x 22" tank containing 10 gallons of 60% ethylene glycol solution. Tank has 2" Fibreglas insulation. External circulating pump added live heat load of about 400 BTU/HR.

GENERAL SPECIFICATIONS

Model Number	Refrigeration Compartment O.D. Inches (Cm.)			Total KVA	Voltage 60 Hz. A.C. 1 Phase
	W.	D.	H.		
PCC-34C-X	28 (70)	23 (58)	19 (48)	1.4	240 V

All wiring complete and enclosed to meet N.E. Code, as amended.

SEND FOR ADDITIONAL INFORMATION AND ALL PRICES

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**BLUE M**

engineered
products in
ACTION

APPLICATION: How to reliably cool/test liquids at temperatures as low as -40°F. with maximum efficiency and convenience.

OPERATING AND CONTROL CHARACTERISTICS

TEMPERATURE RANGE

To -40°F. (-40°C.)

*CONTROL TOLERANCE

±0.15°C.

*CAPACITY

2000 BTU/Hr. at -30°F.

*Performance is subject to a number of variables, including coil size and configuration, and are indicated on opposite page.

BLUE M GUARANTEE

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operating requirements.

SOLUTION:

BLUE M *Constant-Flow* PATENTED PORTABLE COOLING UNIT

This new Blue M Portable Cooling Unit provides industry with a ready means to chill or test liquids at temperatures to as low as -40°F. (-40°C.). A typical application where such units have gained wide acceptance is the testing of various natural gas properties at temperatures to -30°F. Here, the cooling coil is placed in a container of isopropyl alcohol equipped with a second coil with natural gas flowing from the source to an automatic gas analyzer. The cooling coil automatically maintains the temperature of the agitated liquid at the proper test level. Blue M's exclusive Microtrol provides ±0.15°C. control. The unit is also ideal for such other work as direct chilling liquids, auxiliary cooling of parts or components, for indirect chilling, and for innumerable general applications in laboratories and industry.

The unit features Blue M's exclusive Constant-Flow Mechanical Refrigeration System housed in an attractive polished stainless steel housing. Casters facilitate movement wherever required. The coil is connected to the housing by 6-foot long alloy flexible tubing encased in tough plastic. Flexibility permits coil placement as needed without moving compressor compartment.

GENERAL SPECIFICATIONS

CONTROL SYSTEM

BLUE M MICROTROL offers operating sensitivity throughout entire range. Nickel-plated sensing bulb and capillary.

MEMORY RING® Temperature Calibrating Dial.

DIAL POINTER LOCK

PILOT LIGHT

MAIN SWITCH

CONSTRUCTION

HOUSING—all polished stainless steel with adequate

cross ventilating areas to assure proper air circulation. Four ball bearing swivel casters.

CONSTANT-FLOW MECHANICAL REFRIGERATION

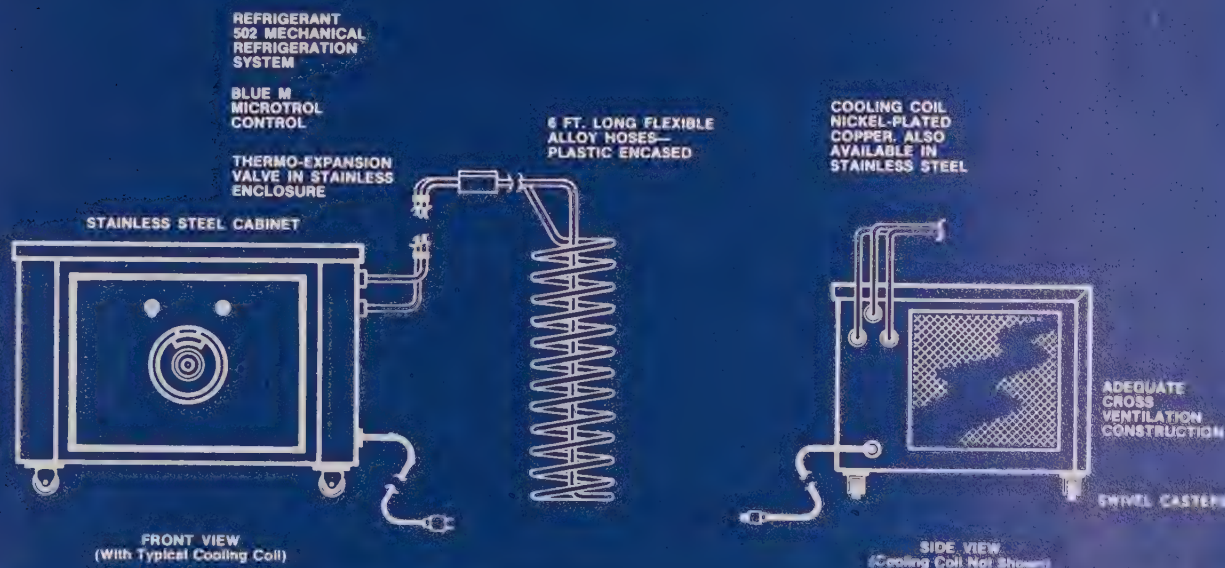
—quality 1 H.P. hermetic type single-stage Refrigerant 502 system. Thermostatic expansion valve serves as metering device. Exclusive hot gas bypass capacity control circuit provides maximum efficiency under all operating conditions. Air-cooling by separate heavy-duty motor driven fan prevents overheating. System operates continuously.

FLEXIBLE HOSES—6' long connect cooling coil and compressor. Alloy tubing encased in tough

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plastic sheath. Coil can be placed as desired without moving compressor compartment.

COOLING COILS—nickel-plated copper. Quality built and thoroughly tested for leaks under pressure. Coil size can be varied to suit individual needs. Stainless steel coils also available. Contact factory for details.

OPERATION

Set control for desired temperature. Refrigeration system automatically lowers temperature of liquid into which the cooling coil has been placed per the typical performance specifications at right.

GENERAL SPECIFICATIONS

Model Number	Typical Coil Size *		Refrigeration Compartment O.D. Inches (Cm.)			Total KVA	Voltage 60 Hz. A.C. 1 Phase
	O.D. Inches (Cm.)	H. Inches (Cm.)	W.	D.	H.		
PCC-50C	7 (18)	19 (48)	28 (70)	23 (58)	19 (48)	1.5	240 V.

*As illustrated above. Coil dimensions may be varied to fit individual requirements but must be equal to above to provide the following unit capacity rating: 2000 BTU/Hr. at -30°F.

Please note: length of time and minimum temperatures obtainable are a function of specific heat of liquid, volume, surface area, insulation losses of container, and whether or not liquid is agitated. Capacity rating shown is based on room temperature at +80°F. or less, evaporator temperature of -46°F., and a coil heat transfer rate of 20 BTU's/sq. ft./°F.

SEND FOR ADDITIONAL INFORMATION AND ALL PRICES

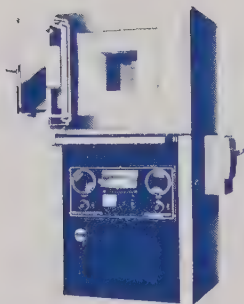
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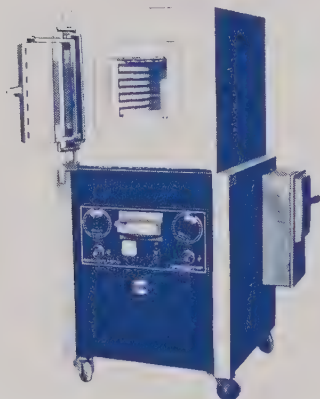
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**POWER-O-MATIC 80
GLOBAR FURNACE**



**POWER-O-MATIC 80
STABIL-GLOW FURNACE**

BLUE M FURNACES

Key to the reliable, long-term operation of equipment at extremely high temperatures is quality construction. Unless a unit is designed with particular care and built of the finest materials, it simply will not withstand the punishing effects of elevated temperatures over prolonged periods.

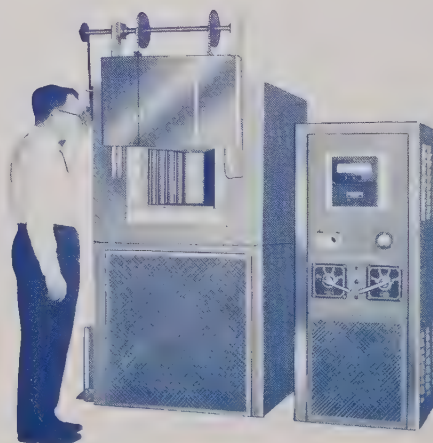
Blue M Furnaces have long been recognized for their ruggedness. All materials, all components are specified on the basis of their quality and dependability under severe operating conditions. This basic quality is then incorporated into units of progressive design which provide industry with efficiency, ease of operation, dependability and economy.

Certainly essential to the basic excellence of any such high temperature test/processing facility are the control system and safety. Fully cognizant of both, Blue M has improved all the furnaces on the following pages by incorporating advanced solid-state instrumentation and overtemperature protection on all models as standard.

Two series—the Rad-O-Glow Globar® Furnace on pages 170 and 171 and the Stabil-Glow Box Type Furnaces on pages 174 and 175 feature Blue M's patented POWER-O-MATIC 80™ Solid-State



**RAD-O-GLOW
GLOBAR FURNACES**



**GLOBAR FURNACE WITH SEPARATE
CONSOLE INSTRUMENT CABINET**

**EQUIPMENT COVERED BY
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and
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SCR Proportioning Control. Designed specifically for critical high temperature service, this modern system provides true straight-line performance at temperatures to $+1620^{\circ}\text{C}$. ($+2950^{\circ}\text{F}$.) Those requiring the ultimate in superior service should review these pages particularly.

The Glocal Furnaces on pages 172 and 173 and the Stabil-Glow Industrial Box Type Furnaces on pages 176 and 177 feature improved solid-state controls. Offering advanced integrated circuitry and time proportioning, this instrumentation provides excellent performance throughout the ranges of both series.

Standardization of overtemperature protection on all Blue M Furnaces in this catalog insures a measure of built-in safety never before available on such equipment. All solid-state, this instrumentation features exclusive Blue M MAX-SET™ time-delay circuitry and operation which eliminates nuisance tripping and greatly simplifies operation.

Worthy of special attention are the heating elements in Blue M Furnaces—either Blue M Modella elements or Glocal elements, depending on the unit. Glocal elements are Carborundum's SGR Series, featuring new spiral groove design. They are made up of special high density recrystallized silicon carbide with a spiraled central hot zone. They assure improved temperature uniformity, excellent resistance to oxidation, and considerably longer Glocal service life than is obtainable with other silicon carbide elements.

Blue M Modella heating elements are an aluminum-chromium-cobalt helically coiled wire ribbon alloy with a melting point of over $+1500^{\circ}\text{C}$. ($+2750^{\circ}\text{F}$.)—considerably higher than the temperature range reached by the furnace to assure complete safety. They are of low-watt density to insure long life. Element plates are extra thick and ribbed, grooved to support elements along entire length. They are made of high heat electrical refractory fired at $+2750^{\circ}\text{F}$.

The elements are placed in the chamber so that heat radiates evenly to all portions of the workload. This assures that the entire workload will undergo exactly the same heat processing regardless of the temperature at which the furnace is set.

We also call your attention to the pages immediately following these which offer a succinct description of heat treating and pertinent terminology used in the industry. We hope you will find this useful to you and your associates.

The success of Blue M's effort to offer the finest furnaces available anywhere can best be judged by the thousands of these units in service and, more specifically, by the examples pictured here and on the following pages. Representing just a sampling of our furnace design and manufacturing ability, they will possibly suggest how our experience can be of help to you. Contact your nearest Blue M Branch Office, or outline your requirements to us direct.



STABIL-GLOW BOX FURNACES

This unusual installation shows the furnace engineering flexibility Blue M can put at your disposal. Four Blue M Box Furnaces are clustered around a single instrument console for maximum operator convenience and efficiency. Furnace stacking saves valuable floor space. Each furnace can be operated independently at different temperatures, and other such modules can be added to provide an entire battery of furnaces in a minimum of space.



STABIL-GLOW BOX FURNACES

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TERMS AND DEFINITIONS USED IN HEAT TREATING

AIR HARDENING

A hardening process wherein the steel is heated to the hardening temperature and cooled in air. (Be sure steel is air-hardening type.)

ANNEALING

Heating and slowing cooling to remove stresses, make steel softer, refine the structure, or change its ductility.

BRINELL HARDNESS

This test consists of forcing a ball of standard diameter into the specimen being tested, under standard pressure, and judging the hardness of the material by the amount of material displaced.

CARBURIZING

Adding carbon to iron base alloys by absorption through heating the metal at a temperature below its melting point in contact with carbonaceous material.

CASE HARDENING

Carburizing and subsequent hardening by heat treatment.

DECARBURIZATION

Removal of carbon. The term usually refers to the removal of carbon from the surface of steel in the presence of heat.

DRAWING

(Tempering) Re-heating, after hardening, to a temperature below the critical for the purpose of reducing the hardness of the steel and increasing its toughness.

HARDENING

(As applied to heat treatment of steel.) Heating and quenching to produce increased hardness.

HEAT TREATMENT

Method of heating and cooling of finished metals or alloys to produce certain desirable properties, such as hardness, softness, ductility, grain refinement, etc.

OIL QUENCH

A quench from the hardening temperature in which oil is the cooling medium.

QUENCHING

The process of cooling rapidly by immersion in oil, water, etc.

QUENCHING TEMPERATURE

The temperature from which steel is quenched during a heat treating process.

QUENCHING MEDIUM

The medium used for cooling steel during heat treatment, usually oil, water, air, or molten salt.

ROCKWELL HARDNESS TEST

This test consists of forcing a cone-shaped diamond or hardened steel ball into the specimen being tested under standard pressure. The depth of penetration is an indication of the Rockwell hardness.

SOAKING

Holding steel at a predetermined temperature for a sufficient time to assure uniform heat penetration and/or to complete the solution of carbides.

TEMPERING

Heating after hardening to a temperature below the critical and then cooling.

WATER QUENCH

(In steel heat treatment.) Cooling steel from its quenching temperature by immersion in water. (A brine solution is a more rapid quench, will produce a harder surface and eliminate possibility of soft spots.)

The following is a simple explanation of heat treatment:

1. Steel undergoes definite internal changes when subjected to a temperature above its critical range.
2. After reaching this temperature, if the steel is allowed to cool naturally, it will return to a normal condition.
3. For steel to return to its normal condition after being heated above its critical range, sufficient time must elapse during the cooling so that the internal changes which took place during heating will have time to reverse themselves.
4. If the heated steel is cooled more rapidly than the internal changes can reverse themselves, then there will be fixed in the steel certain modification of the structure which will alter the physical characteristics of the steel, tensile strength, hardness, toughness, etc.

DRAWING OR TEMPERING

When the steel is fully hardened, it is a highly stressed condition and is too hard and brittle for applications. It is, therefore, necessary to relieve this stressed condition, increase the toughness and ductility, and still retain sufficient hardness and strength. This change can only be made by the application of heat and this process is known as drawing or tempering. This consists of reheating the quenched steel sufficiently to transform the hard martensite into other softer carbides. Different degrees of hardness can be developed in the steel

by utilizing different drawing temperature. The higher the drawing temperature, the softer the steel becomes. An oven with automatic temperature control is recommended for precision work. Be sure to bring the furnace and tool up to temperature together. Do not put cold tool in a hot oven/furnace.

It is very important that this operation be done just as soon as possible after the quench in order to promptly relieve the quenching stresses. In cooling steel after the draw, no change in hardness or ductility will take place whether the steel is cooled rapidly or slowly; however, it is advisable to allow the tool to cool normally in the air rather than quench it because a sudden quench might set up shrinking stresses.

Time is an important element in drawing. More complete stress relief is secured by a longer soak at the drawing temperature. Without increasing the draw temperature, greater toughness is also obtained with a long draw rather than a short one.

Double tempering is a wise precaution. It is a corrective treatment recommended. It can do no harm and may do a lot of good. All steels have a recommended draw temperature for a definite hardness; however, time is a very important factor. The time generally given by the tool steel manufacturer means time at temperature; therefore, in order to get the correct total time in the oven, it is necessary to add the time required for the tool to reach oven temperature; this time element is shown on Chart No. 1.



BLUE M

Unsatisfactory hardening of a tool is most likely caused by:

1. Failure to remove (machine off) sufficient surface of hot rolled bar before hardening.
2. Failure to heat to a high enough temperature.
3. Failure to quench fast enough.
4. Overheated (too high above critical range.)
5. Decarburized surface.
6. Contaminated water or oil.
7. Use of wrong steel.
8. Re-worked tools must be thoroughly annealed before hardening.

HARDENING OF STEEL

The first step in this process is to heat the steel to the correct temperature for quenching. All tool steels have a critical range, and it is necessary to heat the steel above this critical temperature range in order to be able to fix, by quenching, the changes desired. (All companies making tool steel furnished the correct quenching temperature for their steels.) Care must be exercised in the rate of heating. When the steel is placed in a furnace, the temperature of the surface of the steel is first raised and the heat then travels through the steel by conduction toward the center. This progresses until the entire mass has reached the same temperature as the furnace itself. When the steel is first heated, it expands and if a cold piece of steel is placed in a hot furnace, the surface expands more rapidly than the core. The surface will then have a tendency to pull away from the center thus inducing internal stress. In soft steels, this condition is not too important as the steel is sufficiently ductile to accommodate itself to this expansion; however, the harder tool steels are much more susceptible to injury due to rapid heating, and, therefore, should be pre-heated before being placed in a hot furnace. Pre-heating is not actually necessary for small tools if the quenching temperature is below 1600 degrees F., however, if a tool has large or heavy and light sections which are adjacent, it should be pre-heated to avoid excessive temperature gradients that could cause warping or cracking during heating. The average tool steel can be heated at the rate of five minutes per $\frac{1}{8}$ " of thickness.

After the steel is up to temperature, it should be allowed to soak for at least five minutes per inch of diameter or thickness after which it is ready to be quenched. The furnace temperature should never be hotter than the quenching temperature. In other words, if the quenching temperature is 1500 degrees the furnace should be held at that temperature and the steel allowed to reach this temperature. A furnace with automatic temperature control is recommended for precision work.

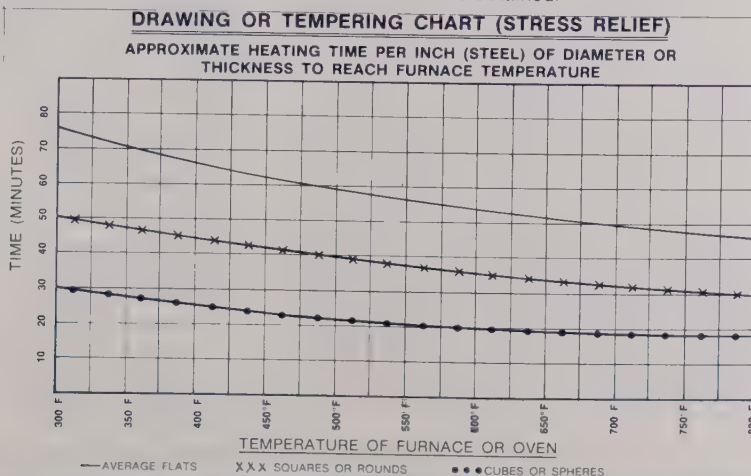
QUENCHING

More steel is ruined in this process than any other phase of heat treating. The purpose of quenching steel is to fix in it some of the changes which have been caused by heating the steel above the critical range. Quenching at the correct temperature results in an increase in hardness and tensile strength.

All tool steels are made for a definite quenching medium for best results and the tool steel company will specify which medium is to be used—air, oil, or water. When using liquid baths, sufficient quenching fluid must be used so that the liquid will not get too hot for effective quenching. Quenching should not be continued beyond the point necessary to produce the required hardness penetration. In other words, the sooner a part can be removed from the quenching bath and the drawing or tempering operation performed, the less will be the danger of quenching cracks. Generally speaking, the tool should be removed from the quench when it is approximately 150 degrees Fahrenheit and then be allowed to cool to room temperature after which it should be immediately placed in the tempering oven.

Approximately one gallon of oil or water should be provided for every pound of steel quenched per hour. If the bath is in constant use, it will be necessary to provide some means of removing the heat by circulating the quenching medium through cooling coils.

Rapid liquid quenching will produce greater difference in hardness between the surface and the center of any large section. Consequently, in large sections, more quenching stresses will be developed. In general, it is not good practice to use a drastic quench to secure surface hardness on large sections. The shape of the part being quenched has a definite relation to the type of quenching medium best suited for the job. When the part consists of thick and thin sections, a drastic quench will harden the thin section before the thick part has had a chance to cool. This premature cooling of one section will produce uneven contraction and stresses which frequently results in cracking. Surface finish is a factor not to be over-looked in quenching. A smooth surface will cool more rapidly in quenching than a surface which is rough machined. This is due to the fact that steam or gas bubbles will adhere more tightly to a rough surface, thus preventing the normal removal of heat during the quench. It is important to circulate the quenching medium rapidly or agitate the parts being quenched so as to prevent this adherence of gas or steam bubbles to the surface of the steel if the maximum quenching effect is to be obtained.



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APPLICATION: How to process metals, ceramics and alloys at elevated temperatures with unequalled dependability, stability, and accuracy.

OPERATIONAL AND CONTROL CHARACTERISTICS

TEMPERATURE RANGE

CONTINUOUS: +649°C. to +1538°C.
(+2800°F.)

INTERMITTENT: to +1620°C.
(+2950°F.)

CONTROL ACCURACY
±3°C.

BLUE M GUARANTEE

When applications are factory approved, we **GUARANTEE** to supply unit(s) meeting your operating requirements.

SOLUTION:

BLUE M RAD-O-GLOW GLOBAR® FURNACES

with ~~POWER-O-MATIC 80~~ **POWER-O-MATIC 80**™ Silicon Controlled Rectifier (SCR) Solid-State Proportioning Control System, Separate Indication and Overtemperature Protection.

The utilization of Blue M's new POWER-O-MATIC 80 Solid-State Proportioning Control System with a furnace of proven engineering excellence has resulted in a high temperature processing facility without equal. The patented SCR control drives a saturable reactor proportioning system, enabling full advantage of the best features of both systems to be realized. The combination provides a control with an extremely narrow proportional band width and virtually no RFI. Also, the constant current characteristics of the saturable reactor system levels out current variations due to the normal wide resistance change undergone by SGR premium grade Globular elements with temperature change and aging. Blue M's low watt density design is one-half that ordinarily recommended, allowing the unit to be operated without overstressing or overloading the elements. Manual tap changing is not required, simplifying operation since the furnace can be run up to maximum temperature *unattended*. There are no tap switches or large power line contactors. The result is unexcelled straight-line temperature control—with Globar element service life increased by approximately 150 to 200%.

Exclusive design includes a 10-turn potentiometer working in conjunction with Blue M's patented Memory Ring® Temperature Calibrating Dial to provide extremely fine setability. A separate dual scale indicating overtemperature protection system functioning in response to its own thermocouple, provides an instantaneous and accurate representation of actual chamber conditions—regardless of control setting. It features Blue M's unique MAX-SET time-delay circuitry which eliminates nuisance tripping. With control and overtemperature protection functioning separately, this furnace assures a level of control accuracy, operational simplicity and safety never before possible.

The furnace is recommended for operations at temperatures from +1500°F./+1600°F. and higher, and is ideal for hardening high speed steels, annealing alloy steels, sintering of powdered metals, copper brazing, aging, forging, laboratory procedures involving ceramics, and heat treatment of ferrous and non-ferrous alloys.

GENERAL SPECIFICATIONS

CONTROL SYSTEM

POWER-O-MATIC 80 SOLID-STATE SCR PROPORTIONING CONTROL SYSTEM offers infinitely proportional, true straight-line performance throughout the unit's range. Designed specifically for control of elevated temperatures. Including a 10-turn potentiometer and working in conjunction with Blue M's patented Memory Ring® Temperature Calibrating Dial, POWER-O-MATIC 80 offers an expanded scale length of over 70" for a remarkable setability of 0.25% of span. Calibration in C. and F.

MAX-SET™ OVERTEMPERATURE PROTECTION: Indicating type, dual scale with range to complement main control and installed conveniently adjacent to it. Indication accuracy ±1% of full scale. Provides constant monitoring over entire span; you see what the chamber temperature actually is at all times. Operates independently of control in response to its own thermocouple.

POTENTIOMETER—10-turn. Insures extremely fine control setability.

THERMOCOUPLES (2)—one for control, one for OTP. Platinum, 13% Rhodium thermocouple in ceramic tube. T/C break protection: furnace automatically shuts down if T/C fails or burns out. Protected by separate fuse.

ELAPSED TIME METER—provides instant indication of hours furnace has actually operated.

MAIN FUSED DISCONNECT SWITCH

VOLTMETER

MAIN SWITCH

PILOT LIGHTS

CONSTRUCTION

HOUSING—all welded extra heavy steel plate, reinforced. ¾" isolated front plate with high temperature aluminum paint. Perimeter of furnace opening isolated from plate and housing to prevent distortion. Baked-on fawn beige enamel exterior finish over prime coat.

REFRACTORY CEMENT—highest quality with safety point well above maximum rating.

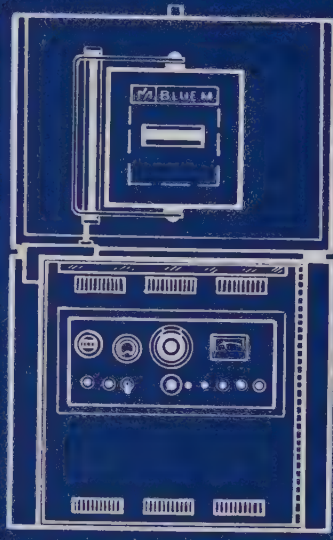
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A BLUE M

STANDARD



FRONT VIEW

HEAVY STEEL
CONSTRUCTION
THROUGHOUT

SWING AWAY
DOOR WITH
EXTRA DOOR
SHIELD

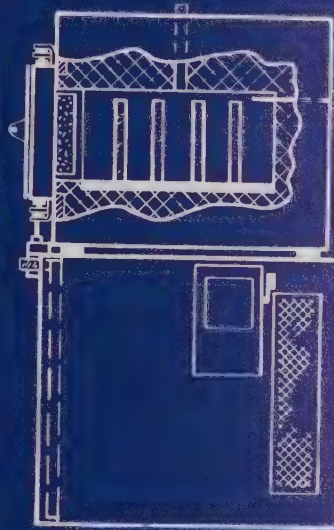
RUGGED DOOR
HARDWARE

BLUE M PATENTED
POWER-O-MATIC 80
SCR SOLID-STATE
PROPORTIONING
CONTROL SYSTEM

MAIN FUSED
DISCONNECT SWITCH

10-TURN POTENTIOMETER

MAX-SET
OVERTEMPERATURE
PROTECTION



SIDE VIEW

PLATINUM
THERMOCOUPLES
WITH
PROTECTION TUBES

PREMIUM GRADE
SGR SPIRAL
GROOVE
SILICON CARBIDE
HEATING ELEMENTS
(MATCHED SET)

SPECIAL HIGH
TEMPERATURE
REFRACTORY
AND CEMENT

SAFETY
DOOR SWITCH

ELAPSED
TIME METER

INSULATION—full 7" thick with +3000°F. service temperature. Lower thermal conductivity reduces heat losses and K.W. requirements.

PREMIUM GRADE SGR GLOBAR HEATING ELEMENTS (MATCHED SET)—spiral groove, mounted vertically from bottom. Minimum heat loss. Special high density recrystallized silicon carbide assures long service life. Easily replaceable.

DOOR—swing-away type, stainless steel enclosure, with 7" refractory. Insulation fits into furnace throat, forms effective chamber seal. Baked-on black enamel hardware.

EXHAUST PORT—allows fumes, vapors, etc., to escape. Has 1" dia. high temperature ceramic tube with plug for sealing vent if not required.

OPERATION

Turn on main switch and set controller to desired temperature. Temperature is automatically held to a fine degree of accuracy with heating of chamber and workload uniform at all points.

GENERAL SPECIFICATIONS

Model Number	Inside Dimensions Inches (Cm.)			Overall Dimensions Inches (Cm.)			Total KVA	*Voltage 50/60 Hz. A.C. Single Phase
	W.	D.	H.	W.	D.	H.		
RG-3080C	8 (20)	12 (31)	8 (20)	30 (76)	36 (90)	60 (152)	12.0	240 V.

*Furnace has 120 V. isolated control circuit. All wiring complete and enclosed to meet amended N.E. Code. A main fused disconnect switch is supplied.

NOTE: FOR PROCESSES REQUIRING LOWER TEMPERATURES, PLEASE REFER TO PAGE 174 DESCRIBING OUR STABIL-GLOW BOX TYPE FURNACES ALSO EQUIPPED WITH POWER-O-MATIC 80. THEY HAVE A RANGE TO +1204°C. (+2200°F.).

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: PROGRAMMING, REPLACEMENT GLOBAR ELEMENTS AND PLATINUM THERMOCOUPLE ASSEMBLY.

SEND FOR ADDITIONAL INFORMATION AND ALL PRICES

BLUE M EQUIPMENT

A SALES AND SERVICE BRANCH OF
BLUE M EQUIPMENT COMPANY
Corporate Headquarters, Blue Island, Illinois 60406

Arizona, Scottsdale 85251
California, El Monte 91731
California, Sunnyvale 94086
Florida, Orlando 32789
Georgia, Atlanta 30341

Illinois, Blue Island 60406
Massachusetts, Framingham 01701
Michigan, Allen Park 48101
New York, Elmsford 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

**BLUE M**engineered
products in**ACTION****APPLICATION:**

How to process metals, ceramics, and alloys simply, dependably and with maximum economy, and yet have furnace capability to +2900°F.

OPERATING AND CONTROL CHARACTERISTICS**TEMPERATURE RANGE CONTINUOUS:**

+1200°F. to +2750°F. (+1510°C.)

INTERMITTENT:

To +2900°F. (+1593°C.)

RUN-UP TIME

Must be brought up to operating temperature very slowly utilizing tap switch.

INDICATION ACCURACY

±1% of scale

CONTROL TOLERANCE: ±5°C.**BLUE M GUARANTEE**

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operating requirements.

SOLUTION:**BLUE M RAD-O-GLOW GLOBAR® FURNACES**

Superior performance . . . unusually high operating temperatures . . . quality construction all contribute towards making these Blue M Box Type Globar Furnaces the best choice for any laboratory or production department needing dependable high temperature testing/processing facilities. They are recommended for hardening high-speed steels, annealing alloy steels, sintering of powdered metals, copper brazing, aging, forging, laboratory procedures involving ceramics, heat treating ferrous and non-ferrous metals, etc.

They feature high density recrystallized silicon carbide heating elements with a spiral heating section. Rated at +3092°F., these radically different elements provide superior temperature uniformity, excellent oxidation resistance, and extended Globar service life. Depending on model, 8, 10 or 18 of these elements are installed along both sides and full muffle height of the furnace. This permits Globar effectiveness to be concentrated on the workload, unimpeded by hearth plates, refractory, etc. New, improved solid-state instrumentation and complementing solid-state overtemperature protection with MAX-SET circuitry assure peak performance and maximum safety.

GENERAL SPECIFICATIONS**CONTROL SYSTEM****SOLID-STATE INDICATING CONTROL POTENTIOMETER**

—fully automatic. Built-in time proportioning reduces overshooting and undershooting. Illuminated direct read-out dial with 8" scale provides setting accuracy to within 0.5% of scale. Centigrade standard; Fahrenheit available on special order. Platinum, 13% Rhodium Thermocouple and T/C break protection; furnace automatically shuts down if T/C fails or burns out.

MAX-SET™ OVERTEMPERATURE PROTECTION

8 WAY TAP CHANGING TRANSFORMER—isolation type. Switching performed in low voltage secondary, isolated from power line.

POWER TAP SWITCH—arc-proof, heavy-duty type. Switch shafts electrically "dead," assuring safety.

U.L. LISTED MERCURY RELAY—silent and fast operating. No exposed arc. Dust and moisture proof.

ELAPSED TIME METER**AMMETER****MAIN SWITCH****PILOT LIGHT****DUAL VOLTAGE****120 V. CONTROL CIRCUIT****CONSTRUCTION**

HOUSING—all-welded extra heavy steel plate, reinforced. ¾" isolated front plate with aluminum paint. Front area around muffle opening is refractory.

REFRACTORY CEMENT—highest quality with melting point well above maximum rating.

INSULATION—refractory backed up with Monoblock. Lower thermal conductivity reduces heat losses and lowers K.W. requirements.

PREMIUM GRADE SGR GLOBAR HEATING ELEMENTS (MATCHED SET)—spiral groove, mounted vertically from bottom. Minimum heat loss. Special high density recrystallized silicon carbide assures long service life. Easily replaceable.

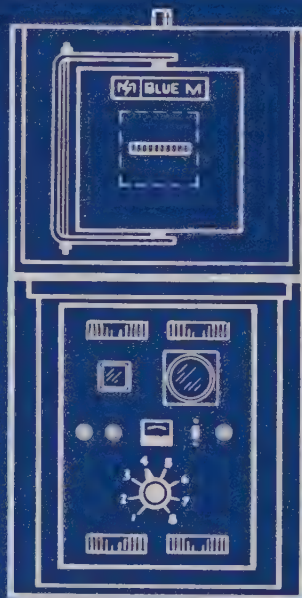
EQUIPMENT COVERED BY
OUR
EXCLUSIVE

PARTS
WARRANTY
and
REPLACEMENT
SERVICE
PROGRAM

**BLUE M**

A BLUE M

STANDARD



FRONT VIEW

SWING AWAY DOOR WITH HEAT SHIELD

RUGGED DOOR HARDWARE

SOLID STATE POTENTIOMETER INDICATING CONTROL

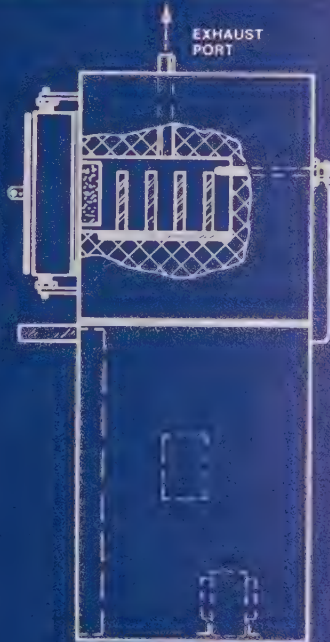
MAX-SET OVERTEMPERATURE PROTECTION

POWER TAP SWITCH

ELAPSED TIME METER

AMMETER

TWO SMALL MODELS ILLUSTRATED



EXHAUST PORT

PLATINUM THERMOCOUPLES WITH PROTECTION TUBES

PREMIUM GRADE SPIRAL GROOVE SERIES SGR SILICON CARBIDE HEATING ELEMENTS (MATCHED SET)

SPECIAL HIGH TEMPERATURE REFRACTORY AND CEMENT

U.L. LISTED SILENT MERCURY POWER RELAY

POWER TRANSFORMER 2 TAPS—ISOLATION TYPE

EXTERIOR FINISH—baked-on fawn beige enamel over primer coat.

DOOR—swing-away type, stainless steel enclosure, with 7" refractory. Insulation fits into furnace throat, forms effective chamber seal. Baked-on black enamel.

EXHAUST PORT—allows fumes, vapors, etc. to escape. Has 1" dia. high temperature ceramic tube with plug for sealing vent if not required.

NOTE: Models RG-3010 have separate console instrument compartment.

OPERATION

Set tap switch to No. 1, 2 or 3 setting initially and then turn on main switch. Set temperature controller. Temperature is automatically held to a fine degree of accuracy with heating of chamber and workload uniform at all points

GENERAL SPECIFICATIONS

Model Number	Inside Dimensions Inches (Cm.)			Overall Dimensions Inches (Cm.)			Total KVA	Voltage 50-60Hz. A.C.	Cubic Inches
	W.	D.	H.	W.	D.	H.			
RG-3000C-2	8 (20)	12 (31)	8 (20)	30 (76)	37 (93)	60 (152)	7.5	240V /1 Ph.	768
RG-3000D-2	8 (20)	12 (31)	8 (20)	30 (76)	37 (93)	60 (152)	7.5	480V /1 Ph.	768
RG-3005C-2	10 (25)	16 (40)	10 (25)	32 (80)	41 (104)	62 (157)	15	240V /1 Ph.	1600
RG-3005D-2	10 (25)	16 (40)	10 (25)	32 (80)	41 (104)	62 (157)	15	480V /1 Ph.	1600
*RG-3010F-2	16 (40)	30 (76)	16 (40)	*66 (167)	54 (136)	*66 (167)	36	240V /3 Ph.	7680
*RG-3010G-2	16 (40)	30 (76)	16 (40)	*66 (167)	54 (136)	*66 (167)	36	480V /3 Ph.	7680

*Includes instrument console.

Dual Voltage: dual voltage power transformer primary permits operation on 208 V., 240 V. or 480 V./1 Ph./50-60 Hz. A.C. for smaller floor model. Larger model wired for 208 V., 240 V., or 480 V./3 Ph./50-60 Hz. A.C. Dual voltage instrument control transformer has 120 V. secondary for isolated control circuit.

All wiring complete and enclosed to meet N.E. Code, as amended.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: REPLACEMENT GLOBAL ELEMENTS, AND PLATINUM THERMOCOUPLE ASSEMBLY.

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Michigan, Allen Park 48101
New York, Elmsford 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

**BLUE M**

engineered
products in
ACTION

OPERATING AND CONTROL CHARACTERISTICS

TEMPERATURE RANGE

***CONTINUOUS:** +150°C. to +1093°C.
(+2000°F.)

INTERMITTENT: to +1204°C.
(+2200°F.)

UNIFORMITY

±1½% of set point.

CONTROL ACCURACY

±2°C.

RUN-UP TIME

To +1093°C.: 90 min.

BLUE M GUARANTEE

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operating requirements.

***NOTE:** This furnace with certain modifications is available for +2200°F. continuous operation and +2300°F. intermittent operation. Prices slightly higher. Contact factory for details.

APPLICATION:

How to test/process at temperatures to +1204°C. (+2200°F.) in a furnace providing the ultimate in straight-line control accuracy, performance and operating ease.

SOLUTION:

BLUE M *Stabil-Glow* BOX TYPE FURNACE

with ~~POWER-O-MATIC-80~~ ^{MINI} **Silicon Controlled Rectifier (SCR) Solid-State Proportioning Control System, Separate Indication and Overtemperature Protection.**

By combining the proven design concepts of an already widely accepted furnace with the inherent superiority of the new POWER-O-MATIC 80 Solid-State Proportioning Control System, Blue M has developed a quality furnace superior to those employing conventional instrumentation and contactors. Unequalled straight-line performance is assured. Blue M's patented control system which includes a high gain solid-state amplifier and SCR's to modulate power to the heating elements. Temperature run-up and stabilization are extremely fast with element life improved considerably.

A single knob simplifies temperature setting. Bias controls or multi-knob adjustments are not needed. A 10-turn potentiometer working in conjunction with Blue M's patented Memory Ring® Temperature Calibrating Dial assures unmatched setability and repeatability, and separate reference charts are unnecessary. A separate dual scale indication overtemperature protection system—functioning in response to its own thermocouple—provides the operator with an immediate and accurate representation of actual chamber conditions—regardless of control setting. It features exclusive MAX-SET time-delay circuitry which avoids nuisance tripping. A built-in voltmeter and elapsed time meter add to the operator's convenience. By having the control and overtemperature protection operating separately, Blue M has achieved a degree of accuracy, simplicity and safety never before possible in a furnace of this type.

The furnace has wide application in such critical operations as machine shops and chemical, optical, environmental and metallurgical facilities involved in heat-treating ferrous/non-ferrous tools and dies, ignition of precipitates, ash determinations, fusion incinerations, glass and ceramic processing and similar work where the fine operating characteristics of the POWER-O-MATIC 80 are required.

GENERAL SPECIFICATIONS

CONTROL SYSTEM

POWER-O-MATIC 80 SOLID-STATE SCR PROPORTIONING CONTROL SYSTEM. Offers infinitely proportional, true straight-line performance throughout the unit's range. Designed specifically for control of elevated temperatures. Including a 10-turn potentiometer and working in conjunction with Blue M's patented Memory Ring® Temperature Calibrating Dial, POWER-O-MATIC 80 offers an expanded scale length of over 70" for a remarkable setability of 0.25% of span. Calibrated in C. and F.

MAX-SET™ OVERTEMPERATURE PROTECTION: Indicating type, dual scale with range to complement main control and installed conveniently adjacent to it. Indication accuracy ±1% of full scale. Provides constant monitoring over entire span; you see what the chamber temperature actually is at all times. Operates independently of control in response to its own thermocouple.

POTENTIOMETER—10-turn. Insures extremely fine control setability.

THERMOCOUPLES (2)—one for control, one for Overtemperature Protection. Magnesium oxide, Inconel sheathed. Type K junction. T/C break protection: furnace automatically shuts down if either T/C fails or burns out.

ELAPSED TIME METER—provides instant indication of hours furnace has actually operated.

MAIN FUSED DISCONNECT SWITCH

VOLTMETER

MAIN SWITCH

PILOT LIGHTS

CONSTRUCTION

HOUSING—all-welded heavy gauge steel plate, reinforced. Instrument compartment well ventilated to reduce heat build-up around control and wiring to within safe specified range. Baked-on faience beige enamel exterior finish.

INSULATION—6" dual insulation. High temperature firebrick, 4½" thick, plus 1½" of Therm-O-Bloc on all six sides. Reduces heat loss.

MODELLA HEATING ELEMENTS—low watt density, helically coiled, for long life. Nonflaking and practically impervious to attack from sulphur and compounds. Wire withstands +2400°F. Element

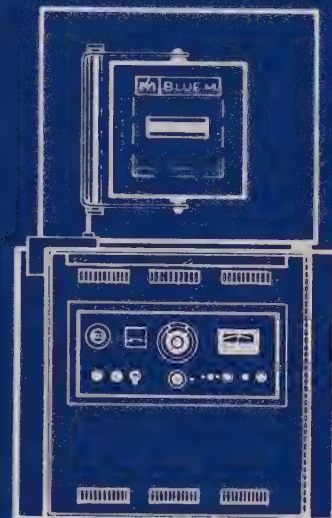
EQUIPMENT COVERED BY
OUR
EXCLUSIVE

PARTS
WARRANTY
and
REPLACEMENT
SERVICE
PROGRAM

**BLUE M**

A BLUE M

STANDARD



FRONT VIEW

HEAVY STEEL
CONSTRUCTION
THROUGHOUT

SWING
AWAY
DOOR

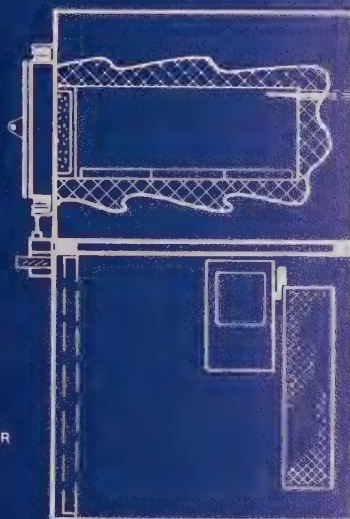
BLACK
ENAMEL
DOOR
HARDWARE

BLUE M PATENTED
POWER-O-MATIC 80
SCR SOLID-STATE
PROPORTIONING
CONTROL SYSTEM

MAIN FUSED
DISCONNECT SWITCH

10-TURN POTENTIOMETER

MAX-SET
OVERTEMPERATURE
PROTECTION



SIDE VIEW

WATER-
MADE INCONEL
SHEATHED
THERMOCOUPLES
WITH T/C
PROTECTION

BLUE M
MODELLA
HEATING
ELEMENTS

7 LOAD TRAYS

ETHERAL
INSULATION

SAFETY
DOOR SWITCH

ELAPSED
TIME
METER

GENERAL SPECIFICATIONS

Model Number	Inside Dimensions Inches (Cm.)			Overall Dimensions Inches (Cm.)			Total KVA	*Voltage 50/60 Hz. A.C. Single Phase
	W.	D.	H.	W.	D.	H.		
8850C	10 (25)	18 (45)	10 (25)	30 (76)	42 (106)	60 (152)	14.0	240 V.
8850D	10 (25)	18 (45)	10 (25)	30 (76)	42 (106)	60 (152)	12.0	480 V.

*All control circuits wired for 120 V. and all power lines are fused for maximum safety and protection. All wiring complete and enclosed to meet amended N.E. Code. Main fused disconnect supplied.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: REPLACEMENT HEATING ELEMENTS, EXTRA THERMOCOUPLE, AND INCONEL MUFFLE.

NOTE: FOR PROCESSING REQUIRING TEMPERATURES TO +1620°C. (+2950°F.), PLEASE REFER TO PAGE 170 FOR A DESCRIPTION OF OUR RAD-O-GLOW GLOBAL® FURNACE ALSO EQUIPPED WITH POWER-O-MATIC 80.

on all four sides, but reversed on bottom to form smooth base for placement of material to be treated. Replaceable.

DOOR—swing-away type, double wall, ventilated to reduce surface temperature during furnace operation. Opens wide for full access to interior. Door bracket and supports black enamel. Phenolic handle. Protective shelf below door.

SAFETY SHUTOFF—automatically breaks circuit to shut off elements when door is opened.

MOLDED REFRACTORY DOOR JAMB—superior to ordinary firebrick customarily used. Long lasting.

ELEMENT PLATES—ribbed, extra thick, crack-resistant. Grooved to support elements along entire length. Made of high-heat electrical refractory fired at +2750°F.

REMOVABLE LOAD TRAYS—molded of high-heat electrical refractory. Three supplied.

OPERATION

Turn on main switch and set controller to desired temperature. Temperature is automatically held to a fine degree of accuracy with heating of chamber and workload uniform at all points.

SEND FOR ADDITIONAL INFORMATION AND ALL PRICES

BLUE M EQUIPMENT

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New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

**BLUE M**

engineered
products in
ACTION

OPERATING AND CONTROL CHARACTERISTICS

TEMPERATURE RANGE CONTINUOUS:

+300°F. to +2000°F. (+1093°C.)

INTERMITTENT:

To +2150°F. (+1177°C.)

INDICATION ACCURACY

±1% of scale

RUN-UP TIME

Since this characteristic is a function of many variables including chamber size, it is difficult to give a meaningful figure because of the many different sizes of units described. However, we can affirm that run-up time performance in these Blue M furnaces equals or surpasses that offered by any comparable competitive equipment.

CONTROL TOLERANCE: ±5°C.

BLUE M GUARANTEE

When applications are factory approved, we GUARANTEE to supply unit(s) meeting your operating requirements.

APPLICATION:

How to conduct such operations as heat-treating and annealing to exacting standards in furnaces large enough to offer complete operational flexibility.

SOLUTION:

BLUE M *Stabil-Glow* INDUSTRIAL BOX TYPE FURNACES

with

Solid-State Proportioning Control System and Solid-State Overtemperature Protection

The complete range of sizes—18 in all, from 2.3 to 30 cu. ft.—plus the superior design construction and operating features of these units enables anyone concerned with large volume, high temperature production work to select the exact furnace needed for the job. Heat-treating and annealing of ferrous and non-ferrous metals, heat-treating of optical glass and high temperature work with ceramics are just a few of the procedures that can be handled in volume efficiently and economically with these quality furnaces.

New, improved solid-state instrumentation and complementing solid-state overtemperature protection with MAX-SET circuitry assure peak performance and maximum safety. Furnaces are complete with solid-state proportioning control system, solid-state overtemperature protection, C/A Inconel sheathed mag./oxide thermocouples, mercury relays, main disconnect switch, load trays, and safety door element shutoff.

It is worth noting that while the larger sizes of these units particularly are ideal for volume production work, the smaller ones are also suitable for certain laboratory applications. As the operating characteristic and details of construction show, these furnaces are capable of fulfilling the most exacting demands with ease.

GENERAL SPECIFICATIONS

CONTROL SYSTEM

SOLID-STATE INDICATING CONTROL POTENTIOMETER

—fully automatic. Illuminated direct read-out dial with 8" scale provides setting accuracy to within 0.5% of scale. Chromel/Alumel thermocouple assembly and T/C break protection: furnace automatically shuts down if T/C fails or burns out. Dual scale.

MAX-SET™ OVERTEMPERATURE PROTECTION

—solid-state instrument similar to and complementing main control. 8" scale. Shuts down unit when pre-selected temperature is reached or in the event of component failure. Dual scale.

MERCURY RELAY

—silent and fast operating. No exposed arc, dust and moisture-proof at all times. Hermetically sealed, mercury to mercury, make and break in a hydrogen atmosphere. Double pole type.

MAIN DISCONNECT SWITCH

PILOT LIGHT

CONSTRUCTION

HOUSING—all-welded extra heavy steel plate and angle iron. ¾" isolated front plate with aluminum paint. Furnace throat sets back adequately to provide efficient heat zone front to back.

INSULATION—9" dual insulation: 7" of quality fire brick backed up with 2" of Mono-Block on all six sides.

EXTERIOR FINISH—baked-on fawn beige enamel.

MODELLA HEATING ELEMENTS—non-flaking, non-oxidizing, and practically impervious to sulphur and its compounds. Installed on all four sides with bottom reversed. Element plates are extra thick and made of +2750°F. electrical refractory.

DOOR AND SAFETY SHUTOFF—air actuated, vertical lift type with hand valve. Sprocket chain drive. Shielded for operator safety. Safety shutoff break circuit when door is opened to shut off elements.

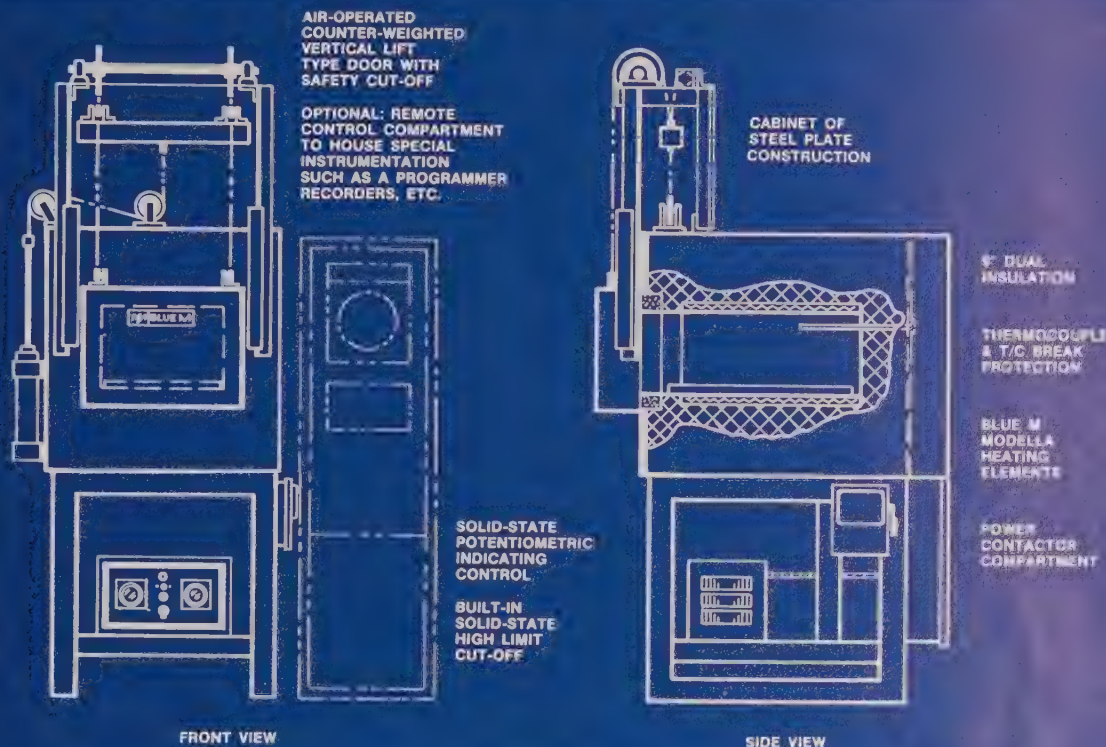
OPERATION

Set control for desired temperature. Temperature is automatically held to a fine degree of accuracy with uniform heating of chamber and workload for quality results.

EQUIPMENT COVERED BY
OUR
EXCLUSIVE

PARTS
WARRANTY
and
REPLACEMENT
SERVICE
PROGRAM

**BLUE M**



GENERAL SPECIFICATIONS

Model Number	Inside Dimensions Inches (Cm.)			Overall Dimensions Inches (Cm.)			Total KVA	Voltage 60 Hz. A.C. 3 Phase	Cubic Feet Cap.
	W.	D.	H.	W.	D.	H.			
*181812G-2	18 1/4 (46)	18 (45)	12 (31)	45 (114)	41 (104)	95 (241)	12	480 V.	2.3
182412G-2	18 1/4 (46)	24 (61)	12 (31)	45 (114)	47 (118)	95 (241)	16	480 V.	3.0
183612G-2	18 1/4 (46)	36 (90)	12 (31)	45 (114)	59 (150)	95 (241)	22	480 V.	4.5
184812G-2	18 1/4 (46)	48 (120)	12 (31)	45 (114)	71 (180)	95 (241)	30	480 V.	6.1
*183618G-2	18 1/4 (46)	36 (90)	18 (45)	45 (114)	59 (150)	101 (257)	33	480 V.	6.8
184818G-2	18 1/4 (46)	48 (120)	18 (45)	45 (114)	71 (180)	101 (257)	45	480 V.	9.1
*241818G-2	24 (61)	18 (45)	18 (45)	51 (128)	41 (104)	101 (257)	22	480 V.	4.5
243618G-2	24 (61)	36 (90)	18 (45)	51 (128)	59 (150)	101 (257)	40	480 V.	9.0
244818G-2	24 (61)	48 (120)	18 (45)	51 (128)	71 (180)	101 (257)	54	480 V.	12.0
*303618G-2	30 (76)	36 (90)	18 (45)	57 (144)	59 (150)	101 (257)	50	480 V.	11.2
304818G-2	30 (76)	48 (120)	18 (45)	57 (144)	71 (180)	101 (257)	60	480 V.	15.0
*363624G-2	36 (90)	36 (90)	24 (61)	63 (159)	59 (150)	111 (282)	60	480 V.	18.0
364824G-2	36 (90)	48 (120)	24 (61)	63 (159)	71 (180)	111 (282)	72	480 V.	24.0

*Also available with I.D. depth of 60" with O.D. depth of 83". Sizes to 30 cu. ft. Write for full information.

All wiring complete and enclosed to meet N.E. Code, as amended.

OPTIONAL ACCESSORIES AVAILABLE INCLUDE: CONSOLE INSTRUMENT COMPARTMENTS, RECORDERS, PROGRAMMERS, PROGRAM TIMERS, EXTRA THERMOCOUPLES, AND MUFFLES.

SEND FOR ADDITIONAL INFORMATION AND ALL PRICES

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New York, Elmsford 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

ACCESSORIES — Supplementary or Replacement Aids Carried in Stock

- SAVE TIME
- PROVIDE CONVENIENCE
- REDUCE COSTS
- ADD VERSATILITY

PARTLOW SINGLE PEN INSTRUMENTS



Specifications For All Units

- Mercury filled thermal element
- Die cast aluminum case
- Electric chart drives 24 hour or 7 day
- Stainless steel bulb and capillary (5')
- Precision calibrations

TR Recording and Indicating Thermometers

Keep permanent record of temperatures for future analysis. Ranges (for either 1 or 7 day drives): +10°C. to +120°C., +40°C. to +230°C., +40°C. to +340°C., and +40°C. to +600°C. Equivalent ranges in Fahrenheit available.

RS Recorder-Controller

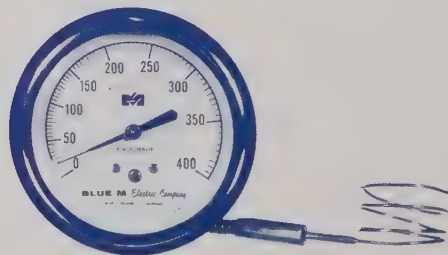
Close sensitivity— $\pm\frac{1}{2}\%$ of scale, close control and permanent record. Ranges (for either 1 or 7 day drives): +10°C. to +120°C., +40°C. to +230°C., +40°C. to +340°C., and +40°C. to +600°C. Equivalent ranges in Fahrenheit available.



WEST MODEL I VERI-TELL

High Resistance Indicating Pyrometers

Accuracy $\pm\frac{1}{2}\%$ of scale Ranges: 0°C. to +250°C. or +400°C.; 0°F. to +500°F. or +700°F. Anti-parallax mirror. Ambient temperature compensation. Iron-Constantan Thermocouple and lead wire.



READY-READ TEMPERATURE INDICATOR

Panel Mounted, Dual Scale

$3\frac{1}{2}$ " diameter dial. 270° dial arc. No gears, springs, etc. —rugged and accurate. Ambient temperature compensation. Easily adjusted or recalibrated. Ranges: -70°C. to +210°C., -30°C. to +105°C., -20°C. to +230°C., 0°C. to +400°C., and equivalent °F. scales.

Acquisition of accessories listed on the following pages permits maximum utility, convenience and efficiency from the equipment in this catalog. We suggest the addition of spare parts with purchase of basic equipment for replacement whenever necessary to minimize shut downs.

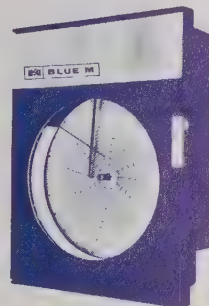
Many of these aids extend the scope or add a new dimension to the usual function of this equipment. The diversified components available will help perform every supplementary operation possible for temperature controlled equipment.

- Positive: accurate
- 10" dia. chart—100 supplied
- Snap-action switches
- All instruments for 120 V./60 Hz./A.C.
- All instruments may be factory installed

RCS Programmer-Controller-Recorder

Cam—blank or cut to your program—furnished. Cam setting attachment allows use as recorder-controller only. Ranges (for either 1 or 7 day drives): +10°C. to +120°C., +40°C. to +230°C., +40°C. to +340°C., and +40°C. to +600°C. Equivalent ranges in Fahrenheit available.

Each item has been carefully selected to provide the ultimate in service, quality, and reliability to meet your most exacting standards or requirements. The fact that these accessories are the same as supplied with some of our products as standard and are manufactured by Blue M Electric Company and the other well known organizations is your assurance of their superiority and dependability. They are all unconditionally guaranteed against defective materials and workmanship.



2 PEN WET AND DRY BULB RECORDER

Total accuracy $\pm 1\%$ of scale. Not connected electrically or mechanically to control system. Monitors and provides records only. Surface mounting. Ambient temperature compensation. 100-12" dia. charts included. Standard range (for either 1 or 7 day drives): -18°C. to +93°C. Available on special order, 0°F. to +200°F.



PARAGON AUTOMATIC TIMER

Memory Master—24 Hour or 7 Day

Quick change, easy-add dial tripper. No need to remove dial. Spring clutch dial drive. Synchronous motor operating indicator. Life-lubricated sealed mechanism. U.L. Listed switch. 40 ampere capacity, 120 V. or 240 V. Available with SPDT or DPST switch.



EAGLE RESET TIMERS

Illuminated Dial Shows Exact Time Status

Quality, synchronous motor driven control instrument which provides an accurate and adjustable time delay between the actuation of a control circuit and the operation of load circuits. Available with a variety of dial ranges from a few minutes up to 60 hours.

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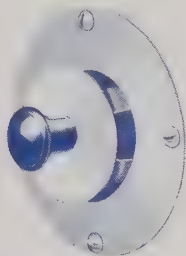
**BLUE M**engineered
products in**ACTION**

ACCESSORIES



MOTORIZED DAMPER ASSEMBLY

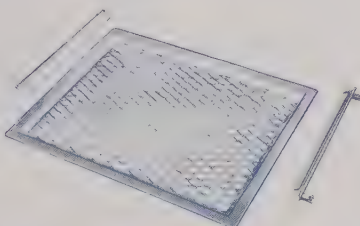
Minneapolis-Honeywell instrument provides two-position zone damper control and switching control for a forced-air heating and/or cooling system. Opens duct damper in 80 seconds, closes it in 160 seconds. Visual indication shows damper position.



STANDARD SIZE LEAD-IN PORTS

With Snap-In Stainless Covers

3" diameter. Standard locations: top, right, left or back wall, centered. Ports for Industrial Batch Ovens normally in right or left side only. Larger and smaller diameters available but must be specified.



EXTRA SHELVES

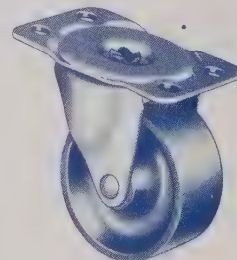
Various types and designs to suit each unit and temperature range.

Constructional materials include heavy steel or stainless expanded metal or wire rod. Angle or tubular framing with reinforcements as required. Special finishes include stainless steel electro-polishing, bright nickel-plating or high temperature aluminum spray.



MAIN DISCONNECT SWITCHES

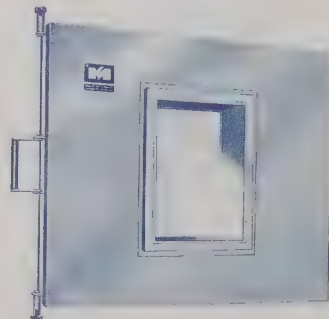
Available on all Blue M Ovens where not supplied as standard. Provides the ultimate in safety by completely shutting down the chamber with the flip of a switch. Conveniently installed and accessible. Normally mounted at side of unit.



CASTERS

Ball Bearing, Swivel Type

For most floor models and floorstands of bench models. Ruggedly built, with hard rubber tread. 3", 4" or 5" diameter, depending on equipment size.

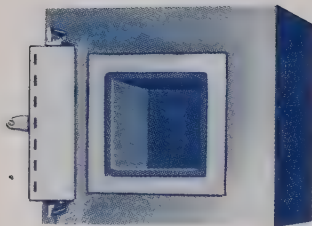


DOUBLE GLASS OBSERVATION PANELS

With Stainless Framing Inside and outside

Clear tempered glass. Built into center of outer door. May also be installed in rear walls. Glass viewing areas in four sizes: from 6½" W. x 8" H. to 13" W. x 19½" H., depending on unit.

**BLUE M**



INCONEL MUFFLES

Protect Heating Elements and Workload

From Dirt and Contaminants During Processing.

For use on Stabil-Glow Furnaces. Constructed of heavy gauge Inconel material including gas inlet pipes, and pipes for thermocouple entry. Muffle limits operating range to +1850°F. NOTE: Must be ordered with furnace for factory installation due to certain modifications required. **Muffles do not permit furnaces to be used for inert gas processing. They do not prevent oxidation.**

SPECIAL PAINT FINISHES

To Match and Enhance the Decor of Your Facility

Although the standard baked-on blue or fawn beige finishes of Blue M chambers and floor cabinets blend well with most installations, customers often request special colors to complement existing facilities. Blue M will finish any unit and/or floor cabinet in any color at only a slight additional charge—with appearance, quality and durability equal to the finishes supplied as standard. You may furnish paint or send sample chip and paint number.

STAINLESS STEEL INTERIORS/EXTERIORS, BLOWER WHEELS AND SHAFTS, SHELVES

For maximum Resistance to Corrosion and for Optimum Cleanliness

While most Blue M Chambers have stainless interiors, some—like the Batch Ovens—are finished with high temperature aluminum paint. Any Blue M Oven is available with stainless interiors, exteriors, blower wheels and shafts, and shelves. Recommended especially if testing/processing/manufacturing procedures involve work with corrosive materials, if oven operates in a corrosive atmosphere, or where cleanliness is important. Besides minimizing maintenance, stainless is easily the best material commercially available and is economical. Type 304, 18% chromium and 8% nickel, is most widely used. However, Blue M is thoroughly experienced with the properties and use of others, including Types 316 and 347, and can authoritatively recommend the one best suited to your needs.

NEMA TYPE 12, SINGLE DOOR, FLOOR MOUNTED CONTROL CONSOLE

Designed to house electrical controls, terminals and similar devices when rugged protection from dust, dirt, oil, coolant and water is desired. Built to NEMA 12 Standards and suitable with J.I.C. Standards when required. Can be installed in certain hazardous locations when equipped with an air purge system. Mounts to right side of unit or remote. Left side mounting must be specified.

Features include: continuously welded seams, ground smooth for attractive appearance; door, sturdily mounted on continuous piano hinge, sealed with cellular neoprene gasket; removable front control panel sealed with cellular neoprene gasket; removable sub-panel mounted on weld studs; rear door has 3-point locking mechanism with cover interlock bracket and latch bar brackets welded to inside; print pocket on door; no knockouts or holes.

BLUE M MAX-SET™

OVERTEMPERATURE PROTECTION PACKAGE—

PROBABLY THE MOST SOPHISTICATED PROTECTIVE INSTRUMENT EVER DEVELOPED

Exclusive design offers features, efficiency, and simplicity never before available in such low-cost instrumentation. Eliminates nuisance tripping. If OTP is activated by a significant line voltage surge or sudden shock, for example, an alarm sounds to alert the operator. Alarm stops once conditions return to normal, the OTP resets automatically, and the chamber continues to operate.

However, should a true overtemperature condition arise, the alarm will sound as MAX-SET shuts down chamber. As chamber conditions reach a temperature below OTP setpoint, alarm stops and chamber is once again activated. If the problem has not been solved, temperature will rise and trip the OTP. Again the alarm will sound and MAX-SET will shut down the unit. This cycle repeats several times until MAX-SET automatically shuts down the chamber and silences the alarm permanently. A red light then signals the operator that the chamber is in a true failed condition and that remedial steps must be taken. After the cause of the failure has been corrected, MAX-SET must be reactivated by a manual switch.

MAX-SET features full scale setability—can be set to operate at any temperature within chamber range. And OTP setpoint is easily established and located—permitting overtemperature setting to be established very close to desired operating temperature, minimizing chance of operator error. MAX-SET may be used on any POWER-O-MATIC 60® controlled unit rated at 50 amps/phase or less, single or three-phase, as well as other equipment with these electrical characteristics and the following temperature ranges: -73°C. to +204°C.; -29°C. to +104°C.; -18°C. to +204°C.; +50°C. to +343°C. Equivalent Fahrenheit scales available.

Interior is finished in white baked-on enamel, front control panel is black enamel, and exterior is finished as specified.

Optional modifications available include a disconnect switch—30, 60 or 100 amp—to shut off power when door is opened; pressurized air purge system for qualified hazardous locations; top mounted fan for inside air recirculation when excessive wattage is being dissipated, and lift rings.

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New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

VALUABLE TECHNICAL DATA

Valuable Information To Help You Derive Maximum Efficiency From Your Equipment

The information on the following pages has been compiled by Blue M and included in this catalog expressly to aid in the more efficient utilization of your equipment.

Of special interest is an authoritative critique on the advantages of a differential recorder in providing a true measure of temperature/humidity chamber performance.

In addition, we have reproduced in their entirety those Sections of current Military Specifications met by various Blue M units in this Catalog. This should be an invaluable and handy guide to anyone involved with testing to these specifications.

Also included are convenient relative humidity conversion tables, and available is the series of Blue M Technical Bulletins described briefly below. They are based upon years of practical engineering/operating experience with temperature controlled equipment. They are available without cost or obligation. Simply fill in one of the handy business reply cards at the back of this catalog, and your copies will be mailed to you promptly.

BLUE M TECHNICAL BULLETINS — AVAILABLE ON REQUEST

No. 100-B

Blue M POWER-O-MATIC 60® Saturable Reactor Proportioning Control System and Range-Lock Overtemperature Protection

A lucid explanation of the value of saturable reactor control systems in general and of the many advantages of this exclusive system in particular. Must reading for anyone concerned with truly accurate, reliable temperature control.

No. 101-A

Blue M MAGNI-WHIRL® Constant Temperature Baths

A discussion of the various important points to be considered when the purchase of a liquid bath is contemplated, and an evaluation of how the patented MAGNI-WHIRL agitation system satisfies these points.

No. 102-A

Blue M VAPOR-TEMP® Controlled Relative Humidity Chamber

Contains pertinent details of another exclusive Blue M development which brings reliable humidity control into the reach of the most modest budget. Although by no means as versatile as other temperature/humidity equipment described in this catalog, Blue M Vapor-Temp units are proving very valuable to many engineers in their work.

No. 103-B

Blue M CONSTANT-FLOW PORTABLE COOLING UNIT

Embodying a new, patented control system, this truly portable unit enables liquids to be cooled anywhere. This Bulletin explains how—and why this heavy-duty unit is first choice among those who need reliable, efficient cooling under a variety of conditions.

No. 104-A

CORROSION RESISTANCE OF STAINLESS STEEL

An invaluable aid to any user of stainless steel equipment. Explains the nature and causes of corrosion, and outlines in simple form the steps to be taken to minimize its damaging effects. Particularly valuable to users of controlled temperature/humidity chambers, baths and other equipment where stainless surfaces come in contact with liquids at elevated temperatures.

No. 107-A

HEATING ELEMENTS AND THEIR APPLICATION TO INDUSTRIAL AND LABORATORY TYPE OVENS

A penetrating analysis of what it takes to make a heated enclosure truly efficient. Includes a discussion of Blue M heating elements. Should be read by everyone owning—or thinking of owning—a temperature controlled cabinet.

No. 109

OVERTEMPERATURE PROTECTION— AN EXTRA MEASURE OF SAFETY NOW STANDARD ON MOST BLUE M UNITS

A down-to-earth summary of the reasons why Blue M has made OTP standard on virtually all products—and why this progressive step is important to anyone concerned with the specifying or purchasing of quality temperature controlled equipment.

TEMPERATURE TIPS:

Brief hints on things to look for when selecting temperature controlled equipment. Beneficial, money-saving tips to help you before you buy.

EXPANDED SCALE RELATIVE HUMIDITY TABLE WET BULB DEPRESSION vs. DRY BULB TEMPERATURE

This table facilitates the determination of exact relative humidity values when a differential recorder or any other measuring device is used that is capable of measuring depression to .1°F. Expanded range covers a maximum of 4°F. depression in .1°F. increments. This is the area of greatest interest in relation to current military specifications.

Wet Bulb depression in °F.		DRY BULB TEMPERATURE — °F.										Wet Bulb depression in °F.
		77 to 81	82 to 87	88 to 95	96 to 103	104 to 113	114 to 127	128 to 141	142 to 149	150 to 161	162 to 171	172 to 200
% RELATIVE HUMIDITY												
0.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0
.1	99.6	99.6	99.6	99.6	99.7	99.7	99.7	99.7	99.7	99.8	99.8	.1
.2	99.2	99.2	99.2	99.2	99.4	99.4	99.4	99.4	99.4	99.6	99.6	.2
.3	98.8	98.8	98.8	98.8	99.1	99.1	99.1	99.1	99.1	99.4	99.4	.3
.4	98.4	98.4	98.4	98.4	98.8	98.8	98.8	98.8	98.8	99.2	99.2	.4
.5	98.0	98.0	98.0	98.0	98.5	98.5	98.5	98.5	98.5	99.0	99.0	.5
.6	97.6	97.6	97.6	97.6	98.2	98.2	98.2	98.2	98.2	98.8	98.8	.6
.7	97.2	97.2	97.2	97.2	97.9	97.9	97.9	97.9	97.9	98.6	98.6	.7
.8	96.8	96.8	96.8	96.8	97.6	97.6	97.6	97.6	97.6	98.4	98.4	.8
.9	96.4	96.4	96.4	96.4	97.3	97.3	97.3	97.3	97.3	98.2	98.2	.9
1.0	96.0	96.0	96.0	96.0	97.0	97.0	97.0	97.0	97.0	98.0	98.0	1.0
.1	95.5	95.6	95.6	95.7	96.6	96.7	96.7	96.8	97.7	97.7	97.8	.1
.2	95.0	95.2	95.2	95.4	96.2	96.4	96.4	96.6	97.4	97.4	97.6	.2
.3	94.5	94.8	94.8	95.1	95.8	96.1	96.1	96.4	97.1	97.1	97.4	.3
.4	94.0	94.4	94.4	94.8	95.4	95.8	95.8	96.2	96.8	96.8	97.2	.4
.5	93.5	94.0	94.0	94.5	95.0	95.5	95.5	96.0	96.5	96.5	97.0	.5
.6	93.0	93.6	93.6	94.2	94.6	95.2	95.2	95.8	96.2	96.2	96.8	.6
.7	92.5	93.2	93.2	93.9	94.2	94.9	94.9	95.6	95.9	95.9	96.6	.7
.8	92.0	92.8	92.8	93.6	93.6	94.6	94.6	95.4	95.6	95.6	96.4	.8
.9	91.5	92.4	92.4	93.3	93.3	94.3	94.3	95.2	95.3	95.3	96.2	.9
2.0	91.0	92.0	92.0	93.0	93.0	94.0	94.0	95.0	95.0	95.0	96.0	2.0
.1	90.6	91.6	91.7	92.6	92.7	93.7	93.7	94.7	94.7	94.8	95.8	.1
.2	90.2	91.2	91.4	92.2	92.4	93.4	93.4	94.4	94.4	94.6	95.6	.2
.3	89.8	90.8	91.1	91.8	92.1	93.1	93.1	94.1	94.1	94.4	95.4	.3
.4	89.4	90.4	90.8	91.4	91.8	92.8	92.8	93.8	93.8	94.2	95.2	.4
.5	89.0	90.0	90.5	91.0	91.5	92.5	92.5	93.5	93.5	94.0	95.0	.5
.6	88.6	89.6	90.2	90.6	91.2	92.2	92.2	93.2	93.2	93.8	94.8	.6
.7	88.2	89.2	89.9	90.2	90.9	91.9	91.9	92.9	92.9	93.6	94.6	.7
.8	87.8	88.8	89.6	89.8	90.6	91.6	91.6	92.6	92.6	93.4	94.4	.8
.9	87.4	88.4	89.3	89.4	90.3	91.3	91.3	92.3	92.3	93.2	94.2	.9
3.0	87.0	88.0	89.0	89.0	90.0	91.0	91.0	92.0	92.0	93.0	94.0	3.0
.1	86.6	87.6	88.6	88.7	89.7	90.7	90.8	91.8	91.8	92.8	93.8	.1
.2	86.2	87.2	88.2	88.4	89.4	90.4	90.6	91.6	91.6	92.6	93.6	.2
.3	85.8	86.8	87.8	88.1	89.1	90.1	90.4	91.4	91.4	92.4	93.4	.3
.4	85.4	86.4	87.4	87.8	88.8	89.8	90.2	91.2	91.2	92.2	93.2	.4
.5	85.0	86.0	87.0	87.5	88.5	89.5	90.0	91.0	91.0	92.0	93.0	.5
.6	84.6	85.6	86.6	87.2	88.2	89.2	89.8	90.8	90.8	91.8	92.8	.6
.7	84.2	85.2	86.2	86.9	87.9	88.9	89.6	90.6	90.6	91.6	92.6	.7
.8	83.8	84.8	85.8	86.6	87.6	88.6	89.4	90.4	90.4	91.4	92.4	.8
.9	83.4	84.4	85.4	86.3	87.3	88.3	89.2	90.2	90.2	91.2	92.2	.9
4.0	83.0	84.0	85.0	86.0	87.0	88.0	89.0	90.0	90.0	91.0	92.0	4.0

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THE DIFFERENTIAL RECORDER IN TEMPERATURE-HUMIDITY TESTING

By J.A. Lawler
Executive Vice President
Blue M Electric Company

The case for the differential recorder as an indispensable tool for establishing strict compliance with military temperature/humidity test specifications . .

One of the major difficulties facing the environmental test laboratory manager today is the lack of a standardized method for determining whether or not temperature and humidity chambers are suitable for meeting particular specifications. The military specifications themselves are explicit as to the conditions that qualifying components must meet. However, little information exists as to what method of testing and/or monitoring to use to obtain acceptable proof that the test chambers themselves are actually complying with the specifications. This situation, I feel, must ultimately be corrected with notably increased emphasis on standardized relative-humidity testing and rigid enforcement of the required tolerances.

Many organizations and companies have established various individual methods of checking that are acceptable at least to themselves. We, as test chamber designers and manufacturers, have also established a standardized method of checking our test chambers for compliance. We use the differential recorder technique. We have chosen this method as a standard because any tolerance established by it has

not been disproved by the various individual company checking methods. Having used and observed this technique on hundreds of temperature/humidity test chambers from a designer's and manufacturer's view point, we find it has many advantages over the other methods I have either tried myself or observed.

The primary purpose of this article is to present the differential recording technique to those who are unfamiliar with it, and to suggest that this method be given consideration in the event a universal standard is eventually proposed.

WHAT IS A DIFFERENTIAL RECORDER?

A differential recorder does exactly what its name implies. It measures and records the difference in temperature between two separate resistance bulbs. Shown schematically in Figure 1 is a differential recorder with resistance bulb A located in chamber A and resistance bulb B located in chamber B. The recorder measures and records only the difference in temperatures between the two chambers. If the respective temperatures are 130°F. in chamber A and 134°F. in chamber B (or 50°F. and 54°F., respectively), the net difference is 4° and will be so recorded. If the two chambers are raised at exactly the same rate, the recorder will continue to record a straight line at 4°F. If, on the other hand, the two chambers rise at a different rate, the recorder will produce a curve pinpointing the difference in temperatures between the two chambers at any given time during the change.

For use in relative humidity determinations, the two sensing bulbs are installed in a conventional wet and dry bulb manner as illustrated in figure 2.

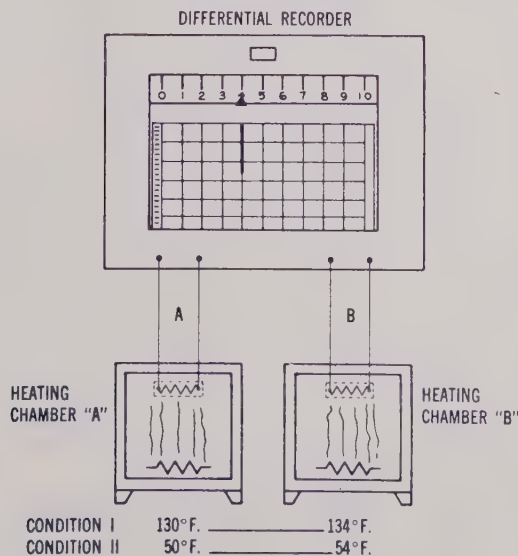


FIG. 1—Schematic representation of differential recorder connected to resistance bulbs in two separate temperature chambers.

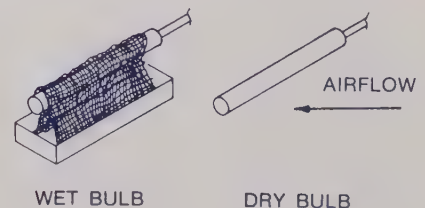


FIG. 2—Manner of installation of differential recorder sensing bulbs for relative humidity determination.

WHY IS A METHOD LIKE THIS REQUIRED?

To justify the use of such more exotic measuring methods, we must first make certain assumptions: (1) The specifications and tolerances listed are realistic; (2) commercial test chambers are available to produce these conditions; and (3) the tolerances are enforced and must be met.

If these assumptions are correct—and there is no reason to believe that they are not—then a superior means of measurement is not only justified, it is mandatory.

Consider for a moment the deficiencies of that old standby—the two-pen circular chart recorder. One A so-called 12-inch chart actually contains only 4½ to 5 inches of calibrated scale length. When 1°F. divisions are no more than 1/64" apart, it becomes impossible to determine fractional degree depressions. Since 1°F. difference can be as much as a 4% relative humidity change, it becomes imperative to have a method of fractional degree determinations.

Two: From the above, I do not believe that accurate interpolation of relative humidity values can be made any closer than approximately 5% at 25°C. and within 3% at +65°C. on even the stabilized portions of the programs. As an example, the width of one recorder line is equivalent to approximately 5% at 25°C., and when the wet and dry bulb lines run together (as they must do to pass a differential test), you cannot determine whether the RH is 100% or 90% by observing the circular chart.

Three: the above problem is quite normal and anyone who has had experience working with humidity test chambers has lived with it for years. One of the real problems arises, however, when a definite relative humidity tolerance is expressed during the transition period from one stabilized condition to another.

This is the initiating factor creating the "eternal triangle" of the environmental industry—the three-way discussions among the chamber manufacturer, the customer, and the Military Acceptance Inspection Agency involving pen offset, descent rates, arc error, etc. It makes little difference which side you take; that is, whether the chart is in tolerance or out of tolerance. Neither can be proved on a circular chart. Thus such arguments are never completely settled; they just sort of dissipate. The reason for this confusion is quite simple. A circular chart recorder is, in my opinion, an inadequate tool for making these determinations for a variable test program because: (1) Scale divisions are too small for accurate depression determinations at the stabilized conditions. (2) There is no convenient method of determining what the precise depression was during an ascending or descending curve recorded by the circular chart at a given instant.

This is not to say that circular charts do not serve a functional purpose. While circular charts will aid in confirming adherence to dry bulb temperature tolerances, the experienced test engineer does not actually compute depressions and/or relative humidity values from the chart. Usually, he has confirmed the operation of his test chamber by more accurate means and can recognize an acceptable pattern produced by the two-pen recorder. As long as the test chamber adheres to this pattern, he knows it will pass the test by a more refined method.

HOW A DIFFERENTIAL RECORDER SOLVES THESE PROBLEMS

A differential recorder provides two major advantages that resolve most relative humidity measuring problems: One: It measures and records only the difference in temperature between the wet bulb and dry bulb sensing bulbs. It does not care at what temperature the bulbs are exposed or whether the temperature is stabilized or changing from one condition to another. Therefore, a continuous recording of depression is obtained throughout an entire program. One needs only a synchronized dry bulb recording to go back and pick off the exact depressions at any instant of the entire program.

Two: The differential recorder is an expanded scale instrument. Full-scale deflection of a 12" strip chart is 10°F. It takes the extremely small depression value that we are interested in and blows it up to a proportion where you can get a good clear view of it. One inch equals 1°F. with .1°F. divisions. Depression values may be read to .05°F.

There are many advantages of lesser importance but nevertheless worth mentioning.

- (1) It is convenient to use. It is still basically a wet and dry bulb measurement technique that everyone is familiar with.
- (2) The long-term stability of resistance bulbs at low temperatures makes it a dependable instrument.
- (3) Extremely light gauge stainless sheathing over the resistance bulbs allows a good response time to small, fast variations.
- (4) Prolonged exposure to saturated conditions and condensation does not affect the calibration.
- (5) Does not require operator attendance to procure readings at given points. Makes a continuous trace of depression that may be examined and plotted at any time and retained for permanent record.
- (6) The stated accuracy of the instrument that we use is $\pm 1/5\%$ of scale range. On a 10°F. full scale, that would be $\pm .02^\circ\text{F}$. Of course, if this degree of accuracy is to be extracted from any commercial instrument, you must also have a highly qualified instrument man with some very sophisticated checking standards. We have found that with the use of reasonably good instrument practices, readings may be relied upon to .1°F.

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(7) From the standpoint of determining relative humidity values only, the dry bulb temperature measurement is not critical and does not require an expensive recorder as long as an accurate depression reading can be taken. As an example, 1°F. depression represents a relative humidity value of 97% at any temperature between 114°F. and 148°F.

(8) Measuring can be conducted in the chamber proper where the specimen is actually tested. This affords a direct and positive measurement of the exact conditions to which the specimen is subjected.

HOW THE DIFFERENTIAL RECORDER IS USED

Figure 3 is a partial reproduction of a MIL-202D differential chart and the simultaneous circular chart. Here is how the test was conducted:

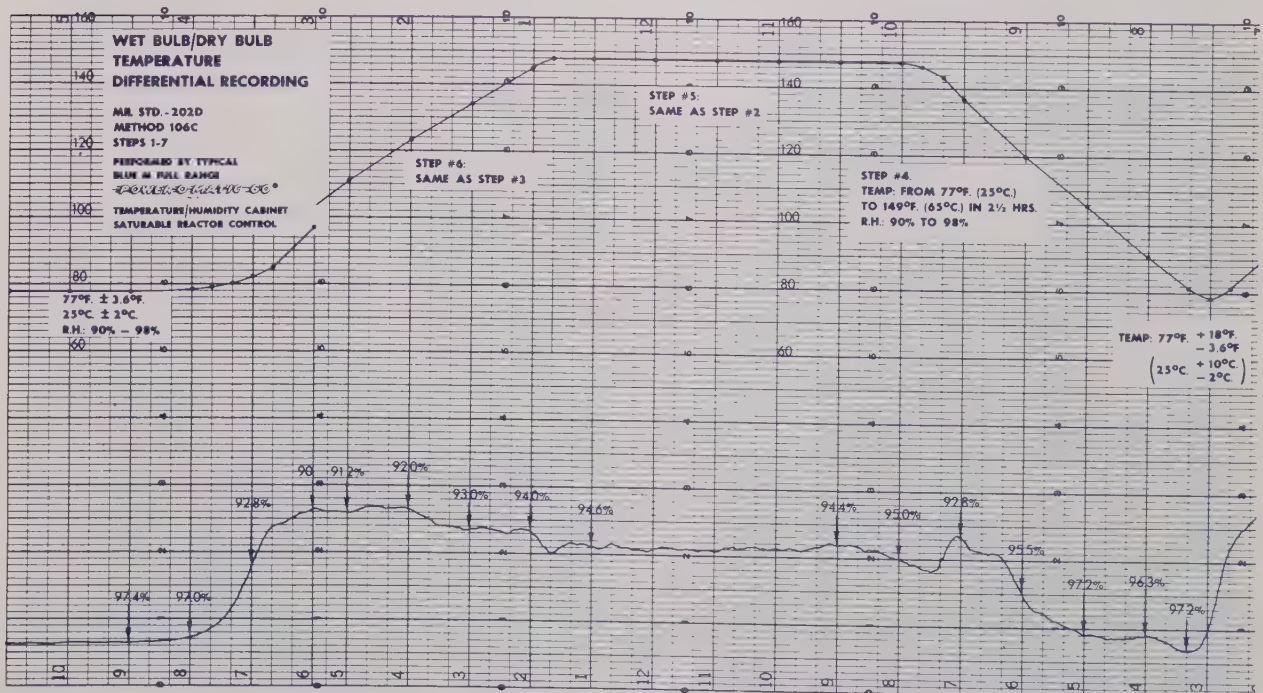
- (1) Differential sensing bulbs were installed in the center of the test chamber in a conventional wet bulb/dry bulb installation. A water reservoir and wick was provided for the wet bulb sensing element.
- (2) The circular chart and differential chart were started at exactly 10:00 a.m. (not shown on partial reproduction).
- (3) The test chamber was allowed to operate for one continuous 24-hour cycle.
- (4) The charts were then removed and the conditions plotted. The bottom line is the actual differential recording trace. The top line is a hand-drawn profile

to represent the temperature conditions of MIL-202D. Exact values of temperature corresponding to any given time are easily obtained from the circular chart recording. Now it is a simple matter to drop down and pick off the exact depression at any point throughout the entire program.

NOTE: At Blue M, we make use of a modified psychrometric chart that gives relative humidity values for .1°F. depression changes over a maximum range of 4°F.

(5) Note particularly the ease with which the exact relative humidity values may be determined during the transition periods. That is, Step 3, Step 4, and Step 6. Here, as many dry bulb points as desired may be plotted to determine the maximum relative humidity variation.

It must be pointed out that this differential chart has been prepared for demonstration purposes. In actual use, it is not plotted so elaborately. For example, the stabilized portion, Step 5, is easily and rapidly checked. It is known that any value of depression between a maximum of 4°F. and a minimum of .5°F. is in tolerance. During a normal check, one would only be concerned that the depression did not exceed either value from a time period of 9:45 p.m. to 12:45 a.m. By merely plotting the minimum and maximum peaks of the differential, the total tolerance is established for this entire step.



As mentioned previously, our experience allows us to recognize the proper pattern and quickly identify and inspect any troublesome areas. We find these areas to be principally at the stabilizing portions of the programs; at the end of one step adjacent to the beginning of the next step. Particularly troublesome are the areas between the end of Step 3 and the beginning of Step 4, and at the end of Step 6 and the beginning of Step 7. The test chamber capability of making a wet descent from a high temperature to a low temperature and the precision with which the cams are cut are the determining factors at these points. If the cams are out of synchronization or are improperly cut, the differential recorder nails it down at these points. If the dry bulb temperature gets away from the control action even momentarily, it will literally drive the differential off the expanded scale.

It is worth noting that the circular chart recorder used here has mercury filled sensing bulbs and the response time is slower than that of the differential recorder. The dry bulb recording pen is approximately 60 seconds behind the true temperature as measured on a 20 gauge exposed tip thermocouple during the relatively slow ascent and descent portions of MIL-202D. However, due to the fact that a given depression is equivalent to a fixed relative humidity value over a wide range of dry bulb temperatures, no compensation was made on the chart shown. The reader may imagine the hand plotted temperature profile at the top of the chart moved to the right a dimension equivalent to even 3 min-

utes—and no appreciable change in relative humidity values will be noted. Obviously, if a fast-responding thermocouple-activated dry-bulb recorder were used, the response times would correlate even more exactly.

WHEN & WHERE SHOULD A DIFFERENTIAL RECORDER BE USED

While there may be some testing critical enough in nature to justify a differential recorder permanently installed on a test chamber, in general, we believe this is not required. Humidity test chambers and associated instrumentation are expensive enough now as it is. However, we do think the real value of the portable monitoring instrument rests in confirming compliance tests periodically on older test chambers and/or qualifying new equipment being installed. A permanent record with visual proof is obtained. It is the one method we know of for obtaining a positive answer to the vexing question, "Am I Really Meeting the Specifications to the Letter?"

Please refer to catalog pages 32 and 33 for a complete description of Blue M Full Range Temperature/Humidity Cabinets—the only chambers in America to meet all aspects of Mil. Spec. Testing as measured and verified by differential recording.

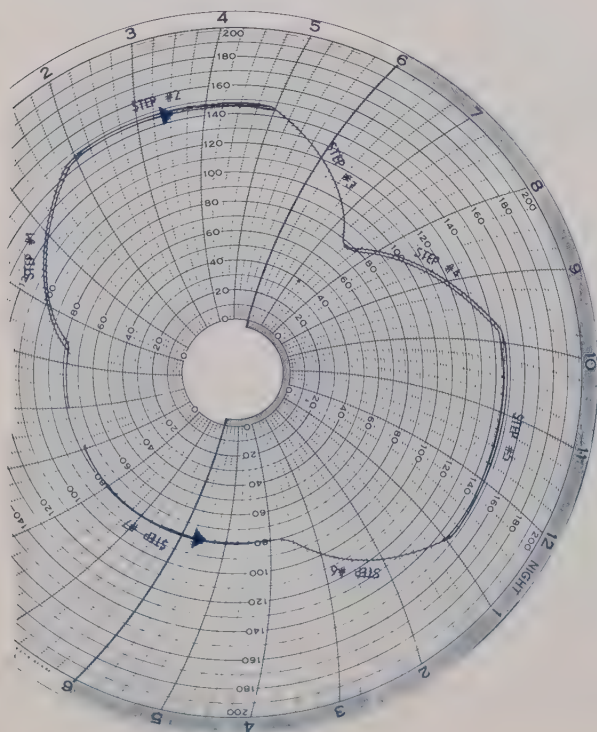


FIG. 3—Partial reproduction of a MIL 202D differential chart and the simultaneous circular chart.

Originals were run on a standard Blue M Full Range Constant Temperature/Humidity Cabinet such as described on pages 32 and 33.

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PRE-ENGINEERED BLUE M CHAMBERS FOR HANDLING HAZARDOUS MATERIALS



TYPICAL FRICTION-AIRE OVEN



TYPICAL CLASS A BATCH OVEN

READY-MADE SOLUTIONS TO ONE OF INDUSTRY'S MOST SERIOUS PROBLEMS TAKE THE DOUBT, GUESSWORK AND WORRY OUT OF SELECTING SAFE EQUIPMENT

Several pages in this catalog are devoted to descriptions of Blue M chambers designed especially for hazardous applications. There are two separate and distinct types of these chambers: Class A Ovens (described on pages 88-91), and patented FRICTION-AIRE™ Ovens, the unique electric chambers with no heating elements (described on pages 72-79).

The design and operating principles of these two kinds of chambers are entirely different. An explanation of them is presented here and on the following pages as an aid to better understanding what hazardous applications are and how this equipment suits them.

As you review this material, however, we urge you to keep one fact in mind: while the Blue M equipment described here is, indeed, pre-engineered for safety, each chamber must, in our judgment, be individually applied. You cannot buy any of these chambers until your application has been thoroughly studied by Blue M to be sure the chamber you select will perform as specified. Once the chamber and the job have been matched, however, you can be sure that your installation is the finest—and safest—you can buy.

WHAT ARE HAZARDOUS APPLICATIONS?

Essentially, any chamber application can be considered hazardous where the workload being heated can combine with the atmosphere around it to produce an explosive mixture. This will never happen with a crowbar or railway car wheel. You can safely heat them all day. But working with paints, lacquers, solvents and similar materials is another matter. Unless precautions are judiciously taken when processing them, they can represent as serious a hazard as can be found anywhere in industry.

Since these materials and such applications as driving volatile solvents used in cleaning, finishing, adhesive and coating processes are the most common uses for temperature controlled chambers, they deserve special emphasis — particularly because they are all hazardous. And they **are** hazardous because they provide the first of two ingredients necessary to produce an explosion in an electric chamber, even if it is operating perfectly:

A flammable mixture of the proper air-to-vapor ratio to be above the lower explosive limit and below the upper explosive limit. When

this ratio is **below** the lower explosive limit, there isn't enough vapor to support combustion. When the ratio is **above** the upper explosive limit, there isn't enough oxygen to support combustion.

The second ingredient needed to produce an explosion is an ignition source — any surface inside the work chamber above the auto-ignition temperature of the material being processed that is in contact with the explosive mixture. A conventional resistance type heating element is considered such an ignition source since it operates at surface temperatures above the ignition points of most finishing materials.

However, a properly designed electrically heated chamber is not in itself hazardous. Only when it is located in an explosive atmosphere or introducing a workload that will release flammable explosive vapors inside is it considered hazardous. A fuel-fired chamber interior, on the other hand, **is** considered a hazardous area whether work is being processed in it or not.

WHAT ARE HAZARDOUS LOCATIONS?

There are two major classifications of hazardous atmospheres:

Class I — those containing flammable gases or vapors

Class II — those containing dust

Atmospheres containing the solvents normally used in finishing are classified in Group D — specifically Class 1, Group D.

An area is classified as Class 1, Group D when enough flammable vapors of Group D solvents are present to produce an ignitable mixture in the atmosphere. Any electrical devices or wiring in such an area must be totally enclosed in suitable enclosures. This implies that the enclosure is strong enough to withstand an explosion, internally ignited by an electrical switch, for example, and not disintegrate or allow a flame to reach the external atmosphere. In addition, no exposed surface may exceed +215°C., the auto-ignition temperature of the lowest of the Group D solvents.

It is improbable that a drying chamber would be located in a Class 1, Group D area. Many processing temperatures would exceed +215°C., and certainly the electric heating element temperature would be over +215°C. Also, it would make little sense to use ambient air already classified as above the lower explosive limit to dilute the additional vapors being released inside the chamber.

WHAT ARE THE REGULATORY CODES?

The current standard covering recommended chamber safety features is in the National Fire Codes prepared by the National Fire Protection Association (NFPA). They include Bulletin 70, the National Electrical Code, and Bulletin 86A, Class A Ovens and Furnaces. They evolved after it was determined that a large number of industrial disasters stemmed directly from fires and explosions in paint drying chambers. A detailed study of these mishaps revealed the most likely causes and suggested the recommended safety features needed to minimize the possibility of their happening. These recommendations — summed up in Bulletin 86A — are automatically provided for in any quality-built Class A Oven.

NFPA Fire Codes are advisory documents. They have been adopted in whole or in part by various city or state governmental codes, insurance agencies such as F.I.A. (Factory Insurance Association) and F.M. (Factory Mutual), and most recently by OSHA. OSHA states simply that drying, curing or fusion apparatus shall conform to the standard for ovens and furnaces and NFPA Bulletin 86A.

Yet, despite this simplicity, it has caused the greatest confusion among most users of chambers. **There is no such thing as an OSHA-approved or F.I.A.-approved chamber.** F.I.A. or F.M. is only interested in seeing that the chamber purchased is suitable for the application. Specifically, they want compliance with all the recommendations of NFPA Bulletin 86A, and the procedure for gaining compliance, too, is simple.

The chamber buyer must define the hazardous material and determine the gallons/hour that must be driven off in the chamber.

The chamber manufacturer must define the specific unit offered with a list of its safety features, its wiring diagram and its exhaust rates. F.I.A. or F.M. reviews these data and either approves the chamber or makes further recommendations. Final approval comes on site after the chamber is installed. Each application is studied and approved individually.

WHAT ARE CHAMBER SAFETY FEATURES?

After a detailed study, Blue M has determined that the following are the major safety features required for any chamber to comply with Bulletin 86A recommendations.

1. Chamber interior seams should be sealed to stop fume infiltration into the insulated walls. Without proper sealing, the fumes will condense on the insulation, possibly causing spontaneous combustion. While not specified, welding is the logical sealing method since it is permanent.
2. A purge timer and door switch must be provided to prevent element heat-up and allow exhaust blowers to run for a preset time after every door opening. This clears excessive fumes from the chamber before energizing a possible ignition source such as the normally fast heating of the element surface or an electrical fault causing an arc inside the chamber. This system operates automatically any time the door is opened or a power failure occurs.
3. Blow-out relief panel of one square foot area per 15 cubic feet of chamber volume. The panel will blow out and relieve internal pressure if a low-level explosion occurs, preventing or minimizing possible damage.
4. Overtemperature protection, preventing uncontrolled temperature rise for any reason, is imperative. It must be independent of the primary control circuit with its own contactor to disconnect the main chamber power line. It should be failsafe: if its sensing element fails, the control will automatically shut down. And it should be a dead front device not easily set without special tools to prevent tampering by unauthorized personnel.
5. Adjustable damper controls designed to prevent complete exhaust close-off under any circumstances.
6. Airflow interlock protection devices to prevent heating element operation unless blower systems are operating. Elements depend upon high volume airflow to maintain their surface temperature within designed watt density parameters. Airflow loss at the start of a bake cycle allows the two requirements for an explosion to occur. Exhaust loss prevents fume clearance and the product load will quickly evaporate solvents, bringing the chamber interior above the lower explosive limit. Also, loss of recirculating air allows element surface temperature to quickly surpass the auto-ignition temperature. Thus, two interlocks are required: an electrical one to disconnect the heating element circuit if the motor overload protection device disconnects the blower motor, and a direct acting mechanical device responding directly to airflow.
7. Direct driven blower systems. However, if vee-belts must be used, then a dual system is essential.
8. Fire extinguishing systems — sprinkler head, CO₂ or foam — responding to the overtemperature protection control or to its own flame or smoke sensitive sensor. This is optional and may be specified by the regulatory agency for very hazardous applications.

Obviously, these are all good common sense features. None can be considered superfluous, too much protection, or unreasonable. Often they are ignored because only a very small amount of flammable solvents are being handled. However, no agency officially recognizes "a mildly hazardous" application. If a flammable vapor is present at all, the application is automatically classified as hazardous.

A review of the Blue M chambers suitable for hazardous applications is presented on the following pages.

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CLASS A BATCH OVENS

These are mechanical convection electric chambers designed specifically to include as standard all the safety features recommended in NFPA Bulletin 86A, as described earlier. These are all indicated in the drawing of a typical model.

These chambers are suitable for Class 1, Group D work. They avoid the complexity and expense of having all electrical devices enclosed in Class 1, Group D housings by assuming that the Class 1, Group D atmosphere will be generated and exist only in the interior of the chamber and be produced from the load itself. Their design

concedes that the element temperature may be well above the auto-ignition points of some flammable materials but this is negated by maintaining a non-explosive mixture through the use of higher than normal exhaust rates. Increased heating element K.W. compensates for this exhaust factor.

Blue M has engineered two entire series of these chambers, each with eight work chamber sizes ranging from 10 to 96 cubic feet (19"W. x 20"D. x 39"H. to 48"W. x 48"D. x 72"H. I.D.). They have a temperature range to +316°C. (+600°F.), and are described on pages 88-91.

INDICATING TYPE
FM-APPROVED
OVERTEMPERATURE
PROTECTION

ADJUSTABLE
AIR DAMPER

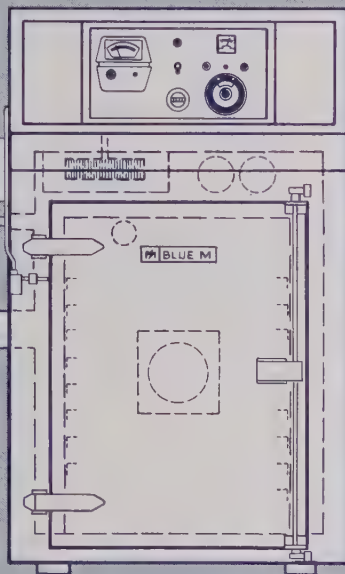
MAIN FUSED
DISCONNECT
SWITCH

AIR
INTAKE

ONE-PASS
AIR-FLOW
SYSTEM

AIR
EXHAUST

PURGE TIMER
AND DOOR
SWITCH



FRONT VIEW

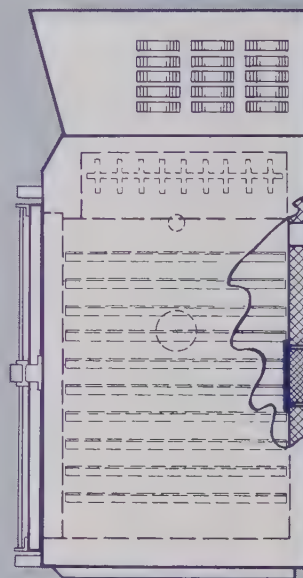
BLUE M
POWER-O-MATIC 60
SATURABLE REACTOR
PROPORTIONING
CONTROL SYSTEM
OR
BLUE M
MICROTRON

QUALITY BLOWER
SYSTEM

ALL-WELDED
INTERIOR

MECHANICAL
HORIZONTAL
AIR-FLOW

NOTE: Three larger models
have controls mounted in
console on right side. Units 48"
wide have two doors.



SIDE VIEW

BLUE M
ETERNA
HEATER
BANK

PORT FOR
FIRE
EXTINGUISHING
SYSTEM

BLOW-OUT
RELIEF PANEL
AND
SAFETY CAGE

FIBERGLAS
INSULATION

WHICH BLUE M CHAMBER DO YOU CHOOSE?

Ultimately, the proper selection will depend upon the use for which the chamber is intended. The application, in short. Trained, fully experienced Blue M engineering personnel will help evaluate your needs and then will make sound, realistic recommendations of the chamber best suited to meet them.

However, as a preliminary aid in determining which kind of Blue M chamber might be preferable, the following brief comparison between the two basic types may be helpful.

Class A Ovens admittedly have an ignition source in the form of heating elements, but minimize the possibility of ignition by diluting vapors below lower explosive limits with high exhaust rates. They have several advantages not the least of which is the fact that they represent a nationally accepted standard with many years of research behind it. There is no question that this type of chamber has

greatly reduced the incidence of oven fires and explosions when properly applied.

This approach accepts the fact that if conditions within the chamber do exceed the lower explosive limit, a definite possibility of an ignition exists. This can result from the failure of a safety device or an exhaust malfunction, improper equipment maintenance, a process or solvent change without a suitable modification of exhaust rates, or improper adjustment of safety devices or exhaust rates to increase production. Also, while the power level can be increased as much as may be needed to meet production requirements, the high exhaust rates of these chambers demand high power expenditures. This could cause a problem if power is ever in short supply or is rationed.

Friction-Aire Ovens, in comparison, allow vapor concentration to remain above the lower explosive limit for a short time but elimi-

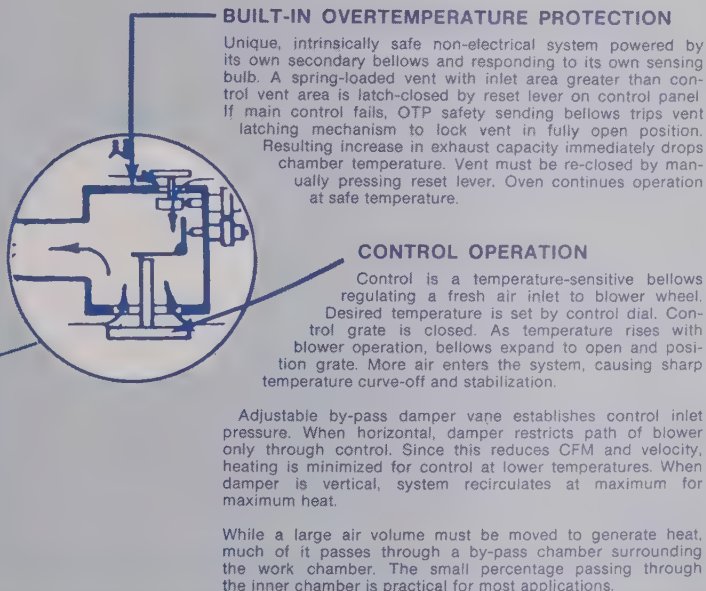
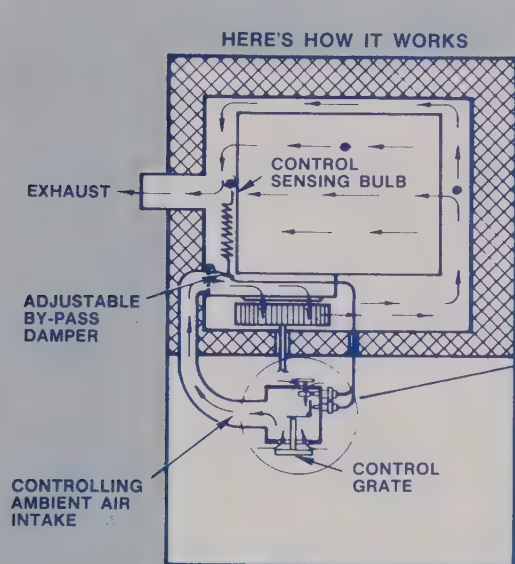
These are unique chambers in that they have **no** heating elements and maintain fine temperature tolerances with a non-electric control system. Heat is generated solely by a large blower system moving air. The operation of these chambers is explained by the captioned drawings.

Friction-Aire chambers are suitable for such extremely hazardous work as those that are truly Class 1, Group D, processing high explosives and work where there can be no possibility of operating below the lower explosive limit. Most work takes place below +100°C.

Models HS-1002EFG, HS-1202EFG and HS-3802EFG are the first electric chambers to be listed by Underwriters' Laboratories for

Class 1, Group D service. U.L. does not distinguish between the inside and outside of the chamber, and assumes that the hazard exists in the surrounding atmosphere. The atmosphere is already explosive and it fills and surrounds the chamber. Under these conditions, heating crowbars is as hazardous as releasing solvents inside the chamber — not because of the work being done but because of the atmosphere the work is done in.

Blue M has engineered several series of Friction-Aire Chambers in conventional and batch configurations. They have chamber sizes to 92 cubic feet (48"W. x 48"D. x 69"H.) and ranges to +150°C. (+302°F.) +204°C. (+400°F.), and +260°C. (+500°F.). They are described on pages 72-79.



nates the most probable ignition source — the heating elements. There are none. Since it has been demonstrated that it is safe to operate three models in a flammable atmosphere, Friction-Aire Ovens should be suitable for processing flammable liquids — at least at temperature to +150°C. — without excessively high exhaust rates. Power consumption is low. Also, with no conventional heat source, no surface temperature in the chamber is greater than the indicated air temperature. Without air movement, there can be no heating — the most positive failsafe air interlock possible. With no heating elements, there is no need for a purge timer system. Maximum temperature obtainable under any conditions is inherently fixed by blower wheel size and motor horsepower selection.

Friction-Aire Ovens include a low exhaust capacity due to their relatively low power generation capability. However, this heat generating capacity is purposely kept low so as not to exceed a

critical value in the event of any type of failure. They are also slower to reach the set temperature than a comparable Class A Oven. Finally, Friction-Aire is a totally new, radically different approach to chamber design, but they have been successfully used in extremely hazardous areas for several years.

While the approaches to safety presented here represent the most advanced and sophisticated methods available today, we must emphasize that processing hazardous materials is always a calculated risk. Just as operating a central home heating system or air travel is risky. There is no completely infallible method of assuring absolute safety — if for no other reason than processing involves people, and people can and do make mistakes. However, this Blue M equipment attacks the safety problem by recognizing the most common causes of fires and explosions and providing the precautions needed to minimize their happening. No equipment can do more.

SEND FOR ADDITIONAL INFORMATION AND ALL PRICES

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METHOD 103B HUMIDITY (STEADY STATE)

MIL-STD-202D
14 April 1969

1. **PURPOSE.** This test is performed to evaluate the properties of materials used in components as they are influenced by the absorption and diffusion of moisture and moisture vapor. This is an accelerated environmental test, accomplished by the continuous exposure of the specimen to high relative humidity at an elevated temperature. These conditions impose a vapor pressure on the material under test which constitutes the force behind the moisture migration and penetration. Hygroscopic materials are sensitive to moisture, and deteriorate rapidly under humid conditions. Absorption of moisture by many materials results in swelling, which destroys their functional utility, and causes loss of physical strength and changes in other important mechanical properties. Insulating materials which absorb moisture may suffer degradation of their electrical properties. This method, while not necessarily intended as a simulated tropical test, is of use in determining moisture absorption of insulating materials.

2. PROCEDURE.

2.1 **Conditioning.** The specimens shall be conditioned in a dry oven at a temperature of $40^\circ \pm 5^\circ\text{C}$. for a period of 24 hours. At the end of this period, measurements shall be made as specified.

2.2 **Chamber.** The chamber and accessories shall be constructed and arranged in such a manner as to avoid condensate dripping on the specimens under test, and such that the specimens shall be exposed to circulating air.

2.3 **Exposure.** The specimens shall be placed in a chamber and subjected to a relative humidity of 90 to 95 percent and a temperature of $40^\circ \pm 2^\circ\text{C}$. for the period of time indicated in one of the following test conditions, as specified:

Test condition	Length of test
A	240 hours
B	96 hours
C	504 hours
D	1,344 hours

When specified, a direct-current potential of 100 volts or as specified shall be applied to the specimens during the exposure period. The length of time for the application of voltage and the points of application shall be as specified.

3. FINAL MEASUREMENTS.

3.1 At high humidity. Upon completion of the exposure period, and while the specimens are still in the chamber, the specified measurements shall be performed. These measurements may be compared to the initial measurements (see 2.1), when applicable.

3.2 After drying period. Upon completion of the exposure period or following measurements at high humidity if applicable, the specimens shall be conditioned at room ambient conditions for a period of 4 hours unless otherwise specified, after which the specified measurements shall be performed at room ambient conditions.

4. SUMMARY.

- The following details must be specified in the individual specification:
- Measurements after conditioning (see 2.1).
 - Test condition letter (see 2.3).
 - The length of time and points of application of polarizing voltage, if applicable (see 2.3).
 - Final measurements:
 - At high humidity, if applicable (see 3.1).
 - After drying period (see 3.2).

METHOD 103B
12 September 1963

METHOD 106C MOISTURE RESISTANCE

MIL-STD-202D
14 April 1969

1. **PURPOSE.** The moisture-resistance test is performed for the purpose of evaluating, in an accelerated manner, the resistance of component parts and constituent materials to the deteriorative effects of the high-humidity and heat conditions typical of tropical environments. Most tropical degradation results directly or indirectly from absorption of moisture vapor and films by vulnerable insulating materials, and form surface wetting of metals and insulation. These phenomena produce many types of deterioration, including corrosion of metals; physical distortion and decomposition of organic materials; leaching out and spending of constituents of materials; and detrimental changes in electrical properties. This test differs from the steady-state humidity test (method 103 of this standard) and derives its added effectiveness in its employment of temperature cycling, which provides alternate periods of condensation and drying essential to the development of the corrosion processes and, in addition, produces a "breathing" action of moisture into partially sealed containers. Increased effectiveness is also obtained by use of a higher temperature, which intensifies the effects of humidity. The test includes low-temperature and vibration subcycles that act as accelerants to reveal otherwise undiscernible evidences of deterioration since stresses caused by freezing moisture and accentuated by vibration tend to widen cracks and fissures. As a result the deterioration can be detected by the measurement of electrical characteristics (including such tests as dielectric withstanding voltage and insulation resistance) or by performance of a test for sealing. Provision is made for the application of a polarizing voltage across insulation to investigate the possibility of electrolysis, which can promote eventual dielectric breakdown. This test also provides for electrical loading of certain components, if desired, in order to determine the resistance of current-carrying components, especially fine wires and contacts, to electro-chemical corrosion. Results obtained with this test are reproducible and have been confirmed by investigations of field failures. This test has proved reliable for indicating those parts which are unsuited for tropical field use.

2. **PROCEDURE.** Specimens shall be tested in accordance with 2.1 to 2.6 inclusive, and figure 106-1.

2.1 **Mounting.** Specimens shall be mounted by their normal mounting means, in their normal mounting position.

2.2 **Initial measurements.** Prior to step 1 of the first cycle, the specified initial measurements shall be made at room ambient conditions, or as specified.

2.3 **Number of cycles.** Specimens shall be subjected to 10 continuous cycles, each as shown on figure 106-1.

2.4 **Subcycle.** During step 7, at least 1 hour but not more than 4 hours after step 7 begins, the specimens shall be either removed from the humidity chamber, or the temperature of the chamber shall be reduced, for performance of step 7a. After step 7b, the specimens shall be returned to 25°C . at 90 to 98 percent relative humidity (RH) and kept there until the next cycle begins. This subcycle shall be performed during any five of the first nine cycles.

2.4.1 **Step 7a.** At least 1 hour but not more than 4 hours after the beginning of step 7, the specimens shall be either removed from the humidity chamber, or the temperature of the chamber shall be reduced. Specimens shall then be conditioned at $-10^\circ \pm 2^\circ\text{C}$. with humidity not controlled, for 3 hours as indicated on figure 106-1. When a separate cold chamber is not used, care should be taken to assure that the specimens are held at $-10^\circ \pm 2^\circ\text{C}$. for the full 3-hour period.

2.4.2 **Step 7b.** Within 15 minutes after completion of step 7a and with humidity not controlled, specimens shall be vibrated for 15 minutes, at room ambient temperature, using a simple harmonic motion having an amplitude of 0.03 inch (0.06-inch maximum total excursion), the frequency being varied uniformly between the approximate limits of 10 and 55 hertz (Hz). The entire frequency range, from 10 to 55 Hz and return to 10 Hz, shall be traversed in approximately 1 minute.

2.5 **Polarization and load.** When applicable, polarization voltage shall be 100 volts, or as specified. The loading voltage shall be as specified.

2.6 Final measurements.

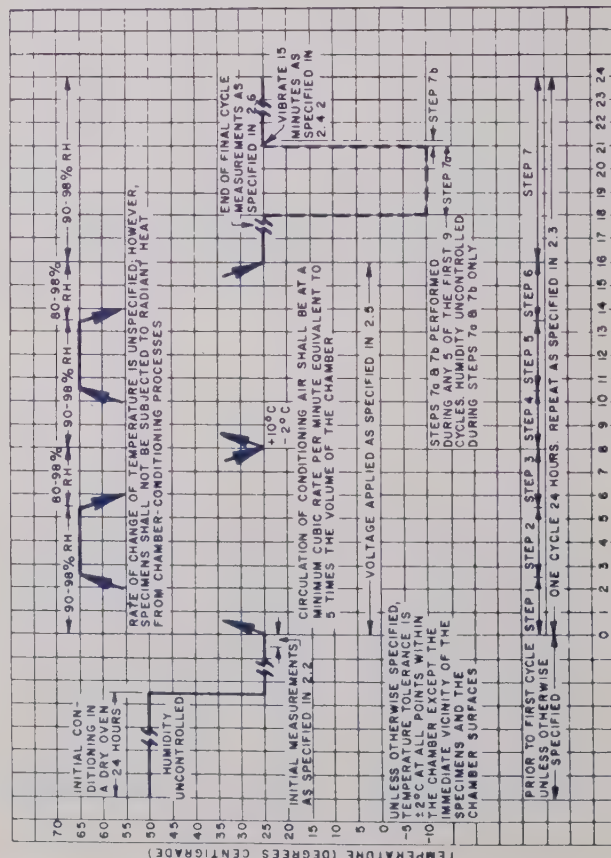
2.6.1 At high humidity. Upon completion of step 6 of the final cycle, when measurements at high humidity are specified, the specimens shall be maintained at a temperature of $25^\circ \pm 2^\circ\text{C}$., and an RH of 90 to 98 percent for a period of $1\frac{1}{2}$ to $3\frac{1}{2}$ hours, after which the specified measurements shall be made. Due to the difficulty in making measurements under high-humidity conditions, the individual specification shall specify the particular precautions to be followed in making measurements under such conditions.

2.6.2 After high humidity. Upon removal from humidity chamber, final measurements shall be made within a period of 1-2 hours after the final cycle. During final measurements, specimens shall not be subjected to any means of artificial drying.

2.6.3 After drying period. Following step 6 of the final cycle, or following measurements at high humidity, if applicable, specimens shall be conditioned for 24 hours at the ambient conditions specified for the initial measurements (see 2.2) after which the specified measurements shall be made. Measurements may be made during the 24-hour conditioning period; however, failures shall be based on the 24-hour period only.

3. SUMMARY.

- The following details must be specified in the individual specification:
- Initial measurements, and conditions if other than room ambient (see 2.2).
 - When applicable, the polarization voltage if other than 100 volts (see 2.5).
 - Loading voltage (see 2.5).
 - Final measurements (see 2.6).



METHOD 507

HUMIDITY

1. **PURPOSE.** The humidity test is applicable to all equipment and is conducted to determine the resistance of equipment to the effects of exposure to a warm, highly humid atmosphere such as is encountered in tropical areas. This is an accelerated environmental test, accomplished by the continuous exposure of the equipment to high relative humidity at an elevated temperature. These conditions impose a vapor pressure on the equipment under test which constitutes the major force behind the moisture migration and penetration. Corrosion is one of the principal effects of humidity. Hygroscopic materials are sensitive to moisture and may deteriorate rapidly under humid conditions. Absorption of moisture by many materials results in swelling, which destroys their functional utility and causes loss of physical strength and changes in other important mechanical properties. Insulating materials which absorb moisture may suffer degradation of their electrical and thermal properties.

2. **APPARATUS.** Humidity-temperature chamber and associated equipment.

2.1 **Chamber.** The chamber and accessories shall be constructed and arranged in such a manner as to avoid condensate dripping on the test item. The chamber shall be trap-vented to the atmosphere to prevent the buildup of total pressure. Relative humidity shall be determined from the dry bulb-wet bulb thermometer comparison method or an equivalent method approved by the procuring activity. When readout charts are used, they shall be capable of being read with a resolution within 0.6°C (1°F). When the wet bulb control method is used, the wet bulb and tank shall be cleaned and a new wick installed at least every 30 days. The air velocity flowing across the wet bulb shall be not less than 900 feet per minute. Provisions shall be made for controlling the flow of air throughout the internal test chamber area where the velocity of air shall not exceed 150 feet per minute. Steam, or distilled, demineralized, or deionized water having a pH value between 6.0 and 7.2 at 23°C (73°F) shall be used to obtain the specified humidity. No rust or corrosive contaminants shall be imposed on the test item by the test facility.

3. PROCEDURES.

3.1 Procedure 1.

Step 1—Place the test item in the test chamber in accordance with section 3, paragraph 3.2.2. Prior to starting the test, the internal chamber temperature shall be at standard ambient with uncontrolled humidity.

Step 2—Gradually raise internal chamber temperature to 71°C (160°F) and the relative humidity to 95 percent over a period of 2 hours.

Step 3—Maintain condition of step 2 for not less than 6 hours.

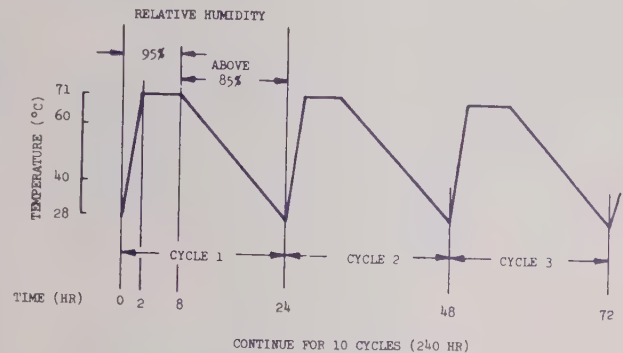
Step 4—Maintain 85 percent, or greater, relative humidity and reduce internal chamber temperature in 16 hours to 28° ± 10°C (82°F).

Step 5—Repeat steps 2, 3, and 4 for 10 cycles (not less than 240 hours). Figure 507-1 is an outline of the humidity cycle for this procedure.

Step 6—Remove the test item from chamber and allow the test item to return to 28° ± 10°C (82°F).

Step 7—Operate the test item and compare results with the data obtained in accordance with section 3, paragraph 3.2.1. Prior to measurements excess moisture may be removed from the exterior surfaces of the test item by turning the test item upside down or by wiping external surfaces only.

Step 8—Inspect the test item in accordance with section 3, paragraph 3.2.4 within 1 hour.



507-1

METHOD 507

METHOD 507

507-6

(Proposed)

METHOD 107C

MIL-STD-202D
14 April 1969MIL-STD-202D
14 April 1969

THERMAL SHOCK

1. **PURPOSE.** This test is conducted for the purpose of determining the resistance of a part to exposures at extremes of high and low temperatures, and to the shock of alternate exposure to these extremes, such as would be experienced when equipment or parts are transferred to and from heated shelters in arctic areas. These conditions may also be encountered in equipment operated noncontinuously in low-temperature areas or during transportation. Although it is preferred that the specimen reach thermal stability at the temperature of the test chamber during the exposure specified, in the interest of saving test time, parts may be tested at the minimum exposure durations specified, which will not insure thermal stability, but only an approach thereto. Permanent changes in operating characteristics and physical damage produced during thermal shock result principally from variations in dimensions and other physical properties. Effects of thermal shock include cracking and delamination of finishes, cracking and crazing of embedding and encapsulating compounds, opening of thermal seals and case seams, leakage of filling materials, and changes in electrical characteristics due to mechanical displacement or rupture of conductors or of insulating materials.

2. **APPARATUS.** Separate chambers shall be used for the extreme temperature conditions of steps 1 and 3. The air temperature of the two chambers shall be held at each of the extreme temperatures by means of circulation and sufficient hot- or cold-chamber thermal capacity so that the ambient temperature shall reach the specified temperature within 2 minutes after the specimens have been transferred to the appropriate chamber.

3. **PROCEDURE.** Specimens shall be placed in such a position with respect to the airstream that there is substantially no obstruction to the flow of air across and around the specimen. When special mounting is required, it shall be specified. The specimen shall then be subjected to the specified test condition of table 107-1. The first five cycles shall be run continuously. After five cycles, the test may be interrupted after the completion of any full cycle, and the specimens allowed to return to room ambient temperature before testing is resumed. One cycle consists of steps 1 through 4 of the applicable test condition. Specimens shall not be subjected to forced circulating air while being transferred from one chamber to another. Direct heat conduction to the specimen should be minimized.

TABLE 107-1. Thermal-shock test conditions.

Step	Test condition	Number of cycles	Test condition	Number of cycles	Test condition	Number of cycles
	A	5	B	5	C	5
Step	A-1	25	B-1	25	C-1	25
	A-2	50	B-2	50	C-2	50
	A-3	100	B-3	100	C-3	100
	Temperature	Time	Temperature	Time	Temperature	Time
1	°C	Minutes	°C	Minutes	°C	Minutes
	-55 +0	(See table 107-2)	-65 +0	(See table 107-2)	-65 +0	(See table 107-2)
2	25 -5	5 max	25 -5	5 max	25 -5	5 max
3	85 +3	(See table 107-2)	125 -0	(See table 107-2)	200 -0	(See table 107-2)
4	25 +10	5 max	25 -5	5 max	25 -5	5 max

METHOD 107C
14 April 1969

TABLE 107-1. Thermal-shock test conditions.—Continued

Step	Test condition	Number of cycles	Test condition	Number of cycles	Test condition	Number of cycles
	D	5	E	5	F	5
Step	D-1	25	E-1	25	F-1	25
	D-2	50	E-2	50	F-2	50
	D-3	100	E-3	100	F-3	100
	Temperature	Time	Temperature	Time	Temperature	Time
1	°C	Minutes	°C	Minutes	°C	Minutes
	-65 +0	(See table 107-2)	-65 +0	(See table 107-2)	65 +0	(See table 107-2)
2	25 +10	5 max	25 +10	5 max	25 +10	5 max
3	350 +5	(See table 107-2)	500 +5	(See table 107-2)	150 +5	(See table 107-2)
4	25 +10	5 max	25 -5	5 max	25 -5	5 max

TABLE 107-2. Exposure time at temperature extremes.

Weight of specimen	Minimum time (for steps 1 and 3)
Pounds	Hours
0.3 and below	½
Above 0.3 to 3 incl.	1
Above 3 to 30 incl.	2
Above 30 to 300 incl.	4
Above 300	8

4. **MEASUREMENTS.** Specified measurements shall be made prior to the first cycle and upon completion of the final cycle, except that failures shall be based on measurements made after the specimen has returned to thermal stability at room ambient temperature following the final cycle.

5. **SUMMARY.** The following details must be specified in the individual specification

- Special mounting, if applicable (see 3).
- Test condition letter (see 3).
- Measurements before and after cycling (see 4)

NOTE: Methods 102 and 107 have substantially the same purpose. Method 107 has been found useful in testing larger components (e.g., transformers) where it is desirable to extend the duration of exposure periods in relation to the weight of the component.

METHOD 107C
14 April 1969

BLUE M EQUIPMENT

A SALES AND SERVICE BRANCH OF
BLUE M EQUIPMENT COMPANY
Corporate Headquarters, Blue Island, Illinois 60406

Arizona, Scottsdale 85251
California, El Monte 91731
California, Sunnyvale 94086
Florida, Orlando 32789
Georgia, Atlanta 30341

Illinois, Blue Island 60406
Massachusetts, Framingham 01701
Michigan, Allen Park 48101
New York, Elmsford 10523
New York, Syracuse 13206

North Carolina, Charlotte 28210
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98108

METHOD 102A TEMPERATURE CYCLING

1. **PURPOSE.** This test is conducted for the purpose of determining the resistance of a part to the shock of repeated surface exposures to extremes of high and low temperatures for comparatively short periods of time, such as would be experienced when equipment or parts are transferred to and from heated shelters in arctic areas. These conditions may also be encountered in equipment operated intermittently in low-temperature areas. It is not required that the specimen reach thermal stability at the temperature of the test chamber during the short exposure time specified. Permanent changes in operating characteristics and physical damage produced during temperature cycling result principally from variations in dimensions and other physical properties, and from alternate condensation and freezing of atmospheric moisture. Effects of temperature cycling include cracking and delamination of finishes, embedding compounds, and other materials, opening of terminal seals and case seams, and changes in electrical characteristics due to moisture effects or to mechanical displacement of conductors or of insulating materials.

2. **APPARATUS.** Separate chambers shall be used for the extreme temperature conditions of steps 1 and 3. The air temperature of the two chambers shall be held at each of the extreme temperatures by means of circulation and sufficient hot- or cold-chamber thermal capacity so that the ambient temperature shall reach the specified temperature within 2 minutes after the specimens have been transferred to the appropriate chamber.

3. **PROCEDURE.** Specimens shall be placed in such a position with respect to the air stream that there is substantially no obstruction to the flow of air across and around the specimen. When special mounting is required, it shall be specified. The specimen shall then be subjected to the specified test condition of table 102-1, for a total of five cycles performed continuously. Specimens shall not be subjected to forced circulating air while being transferred from one chamber to another. Direct heat conduction to the specimen should be minimized.

TABLE 102-1. Temperature-cycling test conditions.

Step	Test condition A ¹ (not preferred)		Test condition B ¹ (not preferred)	
	Temperature °C	Time Minutes	Temperature °C	Time Minutes
1	85 +3 -0	30	65 +3 -0	30
2	25 +10 -5	10 to 15	25 +10 -5	10 to 15
3	-55 +0 -3	30	-55 +0 -3	30
4	25 +10 -5	10 to 15	25 +10 -5	10 to 15
Step	Test condition C (preferred)		Test condition D (preferred)	
	Temperature °C	Time Minutes	Temperature °C	Time Minutes
1	-65 +0 -5	30	-55 +0 -3	30
2	25 +10 -5	10 to 15	25 +10 -5	10 to 15
3	125 +3 -0	30	85 +0 -3	30
4	25 +10 -5	10 to 15	25 +10 -5	10 to 15

¹ Not recommended for use in new or revised specifications.

4. **MEASUREMENTS.** Specified measurements shall be made prior to the first cycle and upon completion of the final cycle, except that failures shall be based on measurements made after the specimen has returned to thermal stability at room ambient temperature following the final cycle.

5. **SUMMARY.** The following details must be specified in the individual specification:

- Special mounting, if applicable (see 3).
- Test condition letter (see 3).
- Measurements before and after cycling (see 4).

METHOD 102A
24 October 1956

METHOD 1010.1 TEMPERATURE CYCLING

1. **PURPOSE.** This test is conducted for the purpose of determining the resistance of a part to exposures at extremes of high and low temperatures, and to the effect of alternate exposures to these extremes, such as would be experienced when equipment or parts are transferred to and from heated shelters in arctic areas. These conditions may also be encountered in equipment operated noncontinuous in low-temperature areas or during transportations. Permanent changes in operating characteristics and physical damage produced during temperature cycling result principally from variations in dimensions and other physical properties. Effects of temperature cycling include cracking and delamination of finishes, cracking and crazing of embedding and encapsulating compounds, opening of thermal seals and case seams, leakage of filling materials, and changes in electrical characteristics due to mechanical displacement or rupture of conductors or of insulating materials.

2. **APPARATUS.** Suitable chamber(s) shall be used for the extreme temperature conditions of steps 1 and 3. The air temperature of the chamber(s) shall be held at each of the extreme temperatures by means of circulation and sufficient hot- or cold-chamber thermal capacity so that the ambient temperature measured downstream of the device under test, shall reach the specified temperature within 5 minutes after the specimens have been transferred to the appropriate chamber.

3. **PROCEDURE.** Specimens shall be placed in such a position with respect to the air stream that there is substantially no obstruction to the flow of air across and around the specimen. When special mounting is required, it shall be specified. The specimen shall then be subjected to the specified conditions for the specified number of cycles performed continuously. Unless otherwise specified, using test condition C, this test shall be conducted for a minimum 10 cycles. One cycle consists of steps 1 through 4 of the applicable test condition with the duration of exposure at each temperature as indicated in the table of test conditions. Whether single or multiple chambers are used, the effective total transfer time from the specified low temperature to the specified high temperature, or the reverse, shall not exceed 5 minutes. Direct heat conduction to the specimen should be minimized. In the case of multiple chambers, the transfer time shall be defined as the time between withdrawal from the low temperature chamber and introduction into the high temperature chamber.

3.1 **Measurements.** After completion of the final cycle, an external visual examination shall be performed for evidence of defects or damage to case, leads, or seals, or loss of marking legibility, resulting from testing. This examination and any additional specified measurements and examination shall be made after completion of the final cycle or upon completion of a group, sequence or subgroup of tests which include this test.

Temperature-cycling test conditions

Step	Minutes	Test condition					
		A Temper- ature	B Temper- ature	C Temper- ature	D Temper- ature	E Temper- ature	G Temper- ature
1	10 min	°C -55 +0 -5	°C -55 +0 -5	°C -65 +0 -5	°C -65 +0 -5	°C -65 +0 -5	°C -65 +0 -5
2	5 max	25 +10 -5	25 +10 -5	25 +10 -5	25 +10 -5	25 +10 -5	25 +10 -5
3	10 min	85 +3 -0	125 +3 -0	150 +5 -0	200 +5 -0	300 +5 -0	175 +5 -0
4	5 max	25 +10 -5	25 +10 -5	25 +10 -5	25 +10 -5	25 +10 -5	25 +10 -5

NOTE: The time at the high and low temperatures shall be sufficient to allow the total mass of each device under test to reach the specified temperature. If carrier or holders employed or other factors make 10 minutes inadequate to allow the mass of each device under test to reach the specified temperature, the time at the temperature extremes shall be increased to meet this requirement. Temperature of worst case loads shall be established with a calibrated thermocouple(s) or other suitable temperature measuring device(s) appropriately placed within the chamber load area.

4. **SUMMARY.** The following details shall be specified in the applicable procurement document:

- Special mounting, if applicable (see 3).
- Test condition letter if other than test condition C (see 3).
- Number of test cycles, if other than 10 cycles (see 3).
- End point measurements and examinations (see 3.1) (e.g., end point electrical measurements, seal test (Method 1014) or other acceptance criteria).

METHOD 1010.1
15 November 1974

MIL-STD-883A
15 November 1974

METHOD 1011.1 THERMAL SHOCK

1. **PURPOSE.** The purpose of this test is to determine the resistance of the device to sudden exposure to extreme changes in temperature. These conditions may be encountered in equipment operated intermittently in low temperature areas. Permanent changes in operating characteristics and physical damage produced during temperature shock result principally from variations in dimensions and other physical properties. Effects of thermal shock include cracking and delamination of substrates or wafers, opening of terminal seals and case seams, and changes in electrical characteristics due to moisture effects or to mechanical displacement of conductors or insulating materials.

2. **APPARATUS.** Suitable temperature controlled baths containing liquids shall be chosen to obtain the temperature excursion specified in the table of test conditions (see 3) and within the indicated tolerances.

3. **PROCEDURE.** The device shall be preconditioned by being immersed in and intimate contact with a suitable liquid at the temperature specified in step 1 of the specified test condition for a minimum of 5 minutes. Immediately upon conclusion of the preconditioning time, the device shall be transferred to a liquid at the temperature specified in step 2 of the specified test condition. The device shall remain at the low temperature for a minimum of 5 minutes and then be transferred to a liquid at the step 1 temperature. The device shall remain at the high temperature for a minimum of 5 minutes. Transfer time from high temperature to low temperature and from low temperature to high temperature shall be less than 10 seconds. Unless otherwise specified, using test condition A, the duration of the test shall be 15 complete cycles, where one cycle consists of proceeding from step 1 to step 2 and back to the beginning of step 1.

3.1 **Measurements.** After completion of the final cycle, an external visual examination shall be performed for evidence of defects or damage to case, leads, or seals, or loss of marking legibility resulting from testing. This examination and any additional specified measurements and examination shall be made after completion of the final cycle or upon completion of a group, sequence or subgroup of test which include this test.

Thermal shock test conditions

Test condition	A	B	C	D	E	F
	Temper- ature °C	Temper- ature °C	Temper- ature °C	Temper- ature °C	Temper- ature °C	Temper- ature °C
Step 1	100 +5 -0	125 +5 -0	150 +5 -0	200 +5 -0	150 +5 -0	200 +5 -0
Step 2	-0 +0 -5	-55 +0 -5	-65 +0 -5	-65 +0 -5	-195 +5 -5	-195 +5 -5

Suggested thermal shock fluids

Test condition	A	B	C	D	E	F
	Fluid	Fluids	Fluids	Fluids	Fluids	Fluids
Step 1	Water 1/	FC40	FC40	Silicon oil or UCON 100	FC40	Silicon oil or UCON 100
Step 2	Water 1/	FC77	FC77	FC77	Liquid nitrogen	Liquid nitrogen

NOTES:

- Water is indicated as an acceptable fluid for this temperature range; its suitability chemically shall be established prior to use.
- Ethylene glycol shall not be used as a thermal shock test fluid.

4. **SUMMARY.** The following details shall be specified in the applicable procurement document:

- Special mounting, if applicable.
- Test condition if other than test condition A (see 3).
- Number of test cycles if other than 15 cycles (see 3).
- End point measurements and examinations (see 3.1) (e.g., end point electrical measurements, seal test (Method 1014) or other acceptance criteria).

METHOD 1011.1
15 November 1974

METHOD 108A
LIFE**(AT ELEVATED AMBIENT TEMPERATURE)**

1. **PURPOSE.** This test is conducted for the purpose of determining the effects on electrical and mechanical characteristics of a part, resulting from exposure of the part to an elevated ambient temperature for a specified length of time, while the part is performing its operational function. This test method is not intended for testing parts whose life is expressed in the number of operations. Evidence of deterioration resulting from this test can at times be determined by visual examination; however, the effects may be more readily ascertained by measurements or tests prior to, during, or after exposure. Surge current, total resistance, dielectric strength, insulation resistance, and capacitance are types of measurements that would show the deleterious effects due to exposure to elevated ambient temperatures.

2. **APPARATUS.** A suitable chamber shall be used which will maintain the temperature at the required test temperature and tolerance (see 3.2) to which the parts will be subjected. Temperature measurements shall be made within a specified number of unobstructed inches from any one part or group of like parts under test. In addition, the temperature measurement shall be made at a position where the effects of heat generated by the parts have the least effect on the recorded temperature. Chamber construction shall minimize the influence of radiant heat on the parts being tested. Chambers which utilize circulating liquid as a heat exchanger, free-convection (gravity-type) chambers, and circulating-air may be used providing that the other requirements of this test method are met. When specified, this test shall be made in still air. (Still air is defined as surrounding air with no circulation other than that created by the heat of the part being operated.) The employment of baffling devices and the coating of their surfaces with a heat-absorbing finish are permitted. When a test is conducted on parts that do not have the still-air requirement, there shall be no direct impingement of the forced-air supply upon the parts.

3. PROCEDURE.

3.1 **Mounting.** Specimens shall be mounted as specified by their normal mounting means. When groups of specimens are to be subjected to test simultaneously, the mounting distance between specimens shall be as specified for the individual groups. When the distance is not specified, the mounting distance shall be sufficient to minimize the temperature of one specimen affecting the temperature of another. Specimens fabricated of different materials, which may have a detrimental effect on each other and alter the results of this test, shall not be tested simultaneously.

3.2 **Test temperature.** Specimens shall be subjected to one of the following test temperatures with accompanying tolerances, as specified:

Temperature and tolerance ¹		Temperature and tolerance ¹	
°C.	°F.	°C.	°F.
70 ±2	(158 ±3.6)	150 ±3	(302 ±5.4)
85 ±2	(185 ±3.6)	200 ±5	(392 ±9)
100 ±2	(212 ±3.6)	350, tolerance as specified.	(662, tolerance as specified.)
125 ±3	(257 ±5.4)	500, tolerance as specified.	(932, tolerance as specified.)

¹ For tests on resistors only, in a still-air environment, the maximum temperature tolerance shall be ±5°C. (±9°F.).

METHOD 108A
12 September 1963METHOD 108A
12 September 1963

3.3 **Operating conditions.** The test potential, duty cycle, load, and other operating conditions, as applicable, applied to the specimen during exposure shall be as specified.

3.4 **Length of test.** Specimens shall be subjected to the following test conditions, as specified:

Test condition	Length of test hours
A	96
B	250
C	500
D	1,000
F	2,000
G	3,000
H	5,000
I	10,000
J	30,000
K	50,000

NOTE: Test condition E (1,500-hour test) has been deleted from this test method.

4. **MEASUREMENTS.** Specified measurements shall be made prior to, during, or after exposure as specified. If applicable, frequency of measurements, and portion of the duty cycle in which measurements are to be made, while the specimen is subjected to test, shall be as specified.

5. **SUMMARY.** The following details must be specified in the individual specification:

- Distance of temperature measurements from specimens, in inches (see 2).
- Still-air requirement, when applicable (see 2).
- Method of mounting and distance between specimens, if required (see 3.1).
- Test temperature and tolerance (see 3.2).
- Operating conditions (see 3.3).
- Test condition letter (see 3.4).
- Measurements (see 4).
 - Prior to, during, or after exposure (see 4).
 - Frequency of measurements, and portions of duty cycle during test, if applicable (see 4).

MIL-STD-883A
15 November 1974**METHOD 1002**
IMMERSION

1. **PURPOSE.** This test is performed to determine the effectiveness of the seal of micro-electronic devices. The immersion of the part under evaluation into liquid at widely different temperatures subjects it to thermal and mechanical stresses which will readily detect a defective terminal assembly, or a partially closed seam or molded enclosure. Defects of these types can result from faulty construction or from mechanical damage such as might be produced during physical or environmental tests. The immersion test is generally performed immediately following such tests because it will tend to aggravate any incipient defects in seals, seams, and bushings which might otherwise escape notice. This test is essentially a laboratory test condition, and the procedure is intended only as a measurement of the effectiveness of the seal following this test. The choice of fresh or salt water as a test liquid is dependent on the nature of the component part under test. When electrical measurements are made after immersion cycling to obtain evidence of leakage through seals, the use of a salt solution instead of fresh water will facilitate detection of moisture penetration. This test provides a simple and ready means of detection of the migration of liquids. Effects noted can include lowered insulation resistance, corrosion of internal parts, and appearance of salt crystals. The test described is not intended as a thermal-shock or corrosion test, although it may incidentally reveal inadequacies in these respects. This is a destructive test and shall not be used as a 100 percent test or screen.

2. **APPARATUS.** The apparatus used for the immersion test shall consist of controlled temperature baths capable of maintaining the temperatures indicated for the hot bath and the cold bath test condition selected. A suitable temperature indicator shall be used to measure bath temperature.

3. **PROCEDURE.** This test consists of successive cycles of immersions, each cycle consisting of immersion in a hot bath of fresh (tap) water at a temperature of 65° ±5° C followed by immersion in a cold bath. The number of cycles, duration of each immersion, and the nature and temperature of the cold bath shall be as indicated in the applicable test condition listed below, as specified. The transfer of specimens from one bath to another shall be accomplished as rapidly as practicable and in no case shall transfer time exceed 15 seconds. After completion of the final cycle, specimens shall be thoroughly and quickly washed in fresh (tap) water or distilled water and all surfaces wiped or air-blasted clean and dry. Unless otherwise specified, measurements shall be made at least 4 hours, but not more than 48 hours, after completion of the final cycle. When specified in the applicable procurement document, upon completion of the electrical measurements and external visual examination, the device shall be delidded or dissected and examined in accordance with method 2013 for evidence of corrosion of internal elements or the appearance of salt crystals. Where this test is performed as part of a group or subgroup of tests, the post-test measurements or inspections need not be performed specifically at the conclusion of this test, but may be performed once at the conclusion of the group or subgroup.

METHOD 1002
1 May 1968

Test condition	No. of cycles	Duration of each immersion Minutes	Immersion bath (cold)	Temperature of cold bath °C
A	2	15	Fresh (tap) water	25 ⁺¹⁰ ₋₅
B	2	15	Saturated solution of sodium chloride and water	25 ⁺¹⁰ ₋₅
C	5	60	Saturated solution of sodium chloride and water	0 ±3
D	5	60	(Parts by Volume) Water-48 parts Methanol*-50 parts Morpholine-1 part 3,5-dimethyl-1-hexyn-3-01-1 part Stannous chloride-5 grams	0 ±3

* Synonyms are tetrahydro-1, 4-oxazine and diethylenimine oxide.

4. **SUMMARY.** The following details must be specified in the applicable procurement document:

- Test-condition letter (see 3). Unless otherwise specified, condition C shall be used.
- Time after final cycle allowed for measurements, if other than that specified (see 3).
- Measurements after final cycle (see 3). Unless otherwise specified, measurements shall include pin-to-pin resistance, pin-to-case resistance and full electrical test of all device characteristics or parameters listed in the applicable procurement document. Final evaluation shall include external visual examination for legibility of device markings and for evidence of discoloration or corrosion of package and leads.
- Dissection and internal examination, where applicable (see 3).

METHOD 1002
1 May 1968

METHOD 1008.1 HIGH-TEMPERATURE STORAGE

1. **PURPOSE.** The purpose of this test is to determine the effect on microelectronic devices of storage at elevated temperatures without electrical stress applied. This method may also be used in a screening sequence or as a preconditioning treatment prior to the conduct of other tests. This test shall not be used to determine device failure rates for other than storage conditions. It may be desirable to make end point and, where applicable, intermediate measurements on a serialized device basis or on the basis of a histogram distribution by total sample in order to increase the sensitivity of the test to parameter degradation or the progression of specific failure mechanisms with time and temperature.

2. **APPARATUS.** The apparatus required for this test shall consist of a controlled temperature chamber capable of maintaining the specified temperature and suitable electrical equipment to make the specified end point measurements.

3. **PROCEDURE.** The device shall be stored at the specified ambient conditions for the specified time. Within the time interval of 24 hours before (0 hours before for test durations less than 250 hours) to 72 hours after the specified duration of the test, the device shall be removed from the specified ambient test condition and allowed to reach standard test conditions. When specified, end-point measurements shall be completed within 96 hours after removal of device from the specified ambient test condition. When specified (or at the manufacturer's discretion, if not specified) intermediate measurements shall be made at intermediate points.

3.1 **Test Condition.** The ambient test temperature shall be indicated by specifying a test condition letter from the following table, unless otherwise specified test condition C and a minimum time duration of 24 hours shall apply.

Test condition	Temperature	Test condition	Temperature
A	75°C	E	250°C
B	125°C	F	300°C
C	150°C	G	350°C
D	200°C	H	400°C

3.1.1 **Temperature-accelerated test.** A special "testing only" maximum microcircuit rating applicable to high temperature, short-duration testing shall be specified in the applicable procurement document. The rated temperature value should be chosen from the table of 3.1. (To properly select this rating, it is recommended that an adequate sample of devices be exposed to the intended high temperature for at least the corresponding time duration (see figure 1008-1), to ascertain that any failure mechanisms observed do not differ from those observed at lower temperatures over equivalent longer test durations per figure 1008-1.)

At the supplier's option, the specific time and temperature value may be used in conjunction with the graph of figure 1008-1 to establish other testing conditions equivalent to those specified. Allowable equivalent time-temperature combinations shall be chosen by drawing through the point of figure 1008-1 corresponding to the specified time and temperature a straight line parallel to the given regression line, any time-temperature combination which lies on or above this parallel line, within the time limits indicated in figure 1008-1 may be used.

4. **SUMMARY.** The following details shall be specified in the applicable procurement document:

- Test condition letter if other than test condition C (see 3.1).
- Test duration if other than 24 hours (see 3.1).
- End point measurements, if applicable (see 3).
- Intermediate measurements, if applicable (see 3).
- Maximum accelerated test temperature rating (see 3.1.1) if applicable.

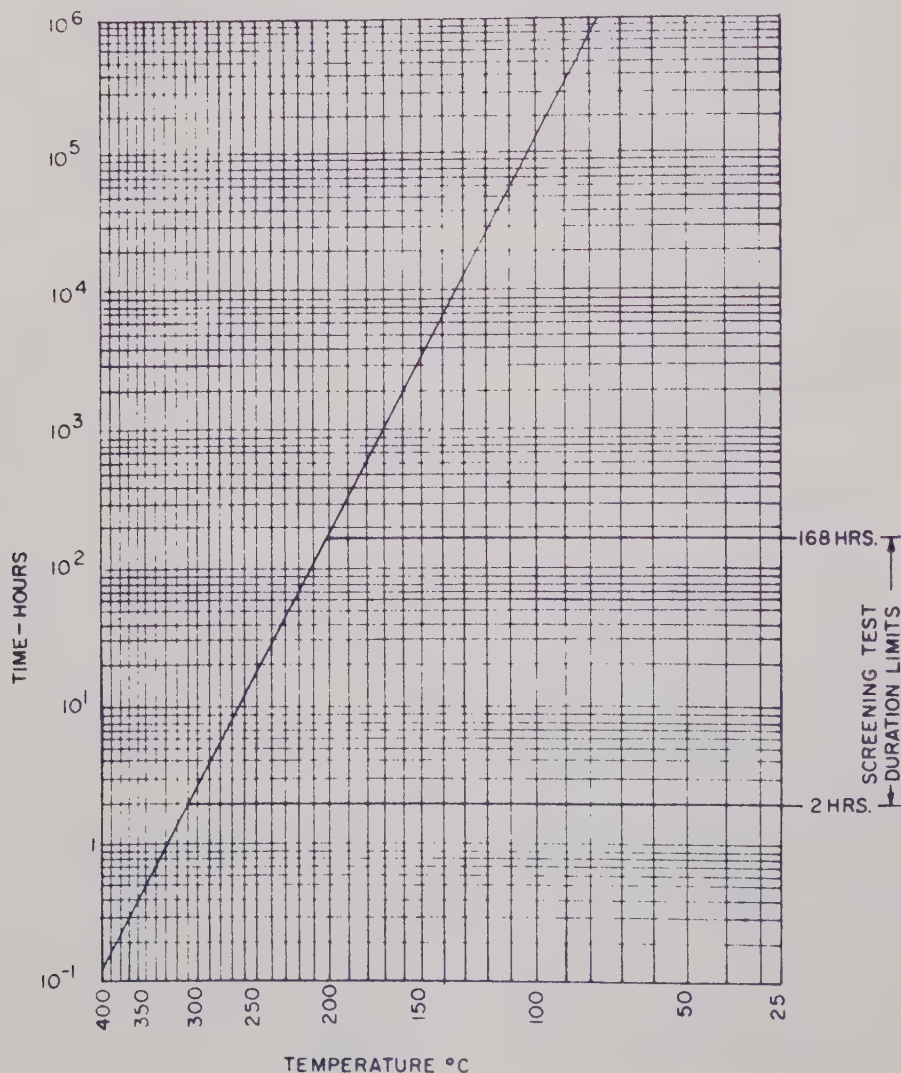


FIGURE 1008-1. Time-temperature regression and allowable time limits for test condition F.

METHOD 1008.1
15 November 1974



CENTIGRADE TABLE OF RELATIVE HUMIDITY OR PERCENT OF SATURATION

Dry Bulb Deg. C.	Difference Between Readings of Wet and Dry Bulbs in Degrees Centigrade																																								Dry Bulb Deg. C.
	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5	6	7	8	9	10	11	12	13	14	15	16	18	20	22	24	26	28	30	32	34	36	38	40								
2	92	83	75	67	59	52	43	36	27	20																										2					
4	93	85	77	70	63	56	48	41	34	28	15																									4					
6	94	87	80	73	66	60	54	47	41	35	23	11																								6					
8	94	87	81	74	68	62	56	50	45	39	28	17																								8					
10	94	88	82	76	71	65	60	54	49	44	34	23	14																							10					
12	94	89	84	78	73	68	63	58	53	48	38	30	21	12	4																					12					
14	95	90	84	79	74	69	65	60	55	51	41	33	24	16	10																					14					
16	95	90	85	81	76	71	67	62	58	54	45	37	29	21	14	7																				16					
18	95	90	86	82	78	73	69	65	61	57	49	42	35	27	20	13	6																			18					
20	96	91	87	82	78	74	70	66	62	58	51	44	36	30	23	17	11																			20					
22	96	92	87	83	79	75	72	68	64	60	53	46	40	34	27	21	16	11																		22					
24	96	92	88	85	81	77	74	70	66	63	56	49	43	37	31	26	21	14	10																	24					
26	96	92	89	85	81	77	74	71	67	64	57	51	45	39	34	28	23	18	13																	26					
28	96	92	89	85	82	78	75	72	68	65	59	53	47	42	37	31	26	21	17	13																28					
30	96	93	89	86	82	79	76	73	70	67	61	55	50	44	39	35	30	24	20	16	12															30					
32	96	93	90	86	83	80	77	74	71	68	62	56	51	46	41	36	32	27	23	19	15															32					
34	97	93	90	87	84	81	77	74	71	69	63	58	53	48	43	38	34	30	26	22	18	10														34					
36	97	93	90	87	84	81	78	75	72	70	64	59	54	50	45	41	36	32	28	24	21	13														36					
38	97	94	90	87	84	81	79	76	73	70	65	60	56	51	46	42	38	34	30	26	23	16	10													38					
40	97	94	91	88	85	82	79	76	74	71	66	61	57	52	48	44	40	36	32	29	25	19	13													40					
42	97	94	91	88	85	82	80	77	74	72	67	62	58	53	49	45	41	38	34	31	27	21	15													42					
44	97	94	91	88	86	83	80	77	75	73	68	63	59	54	50	47	43	39	36	32	29	23	17	12												44					
46	97	94	91	89	86	83	81	78	76	73	68	64	60	55	52	48	44	41	37	34	31	25	19	14												46					
48	97	94	92	89	86	84	81	78	76	74	69	65	61	56	53	49	45	42	39	35	33	27	21	16	12											48					
50	97	94	92	89	87	84	82	79	77	75	70	65	62	57	54	50	47	43	40	37	34	28	23	18	14											50					
52	97	94	92	89	87	84	82	79	77	75	70	66	62	58	55	51	48	44	41	38	35	30	25	20	16	11										52					
54	97	95	92	90	87	85	82	80	78	76	71	67	63	59	56	52	49	45	42	39	36	31	26	21	17	13										54					
56	97	95	92	90	87	85	83	80	78	76	72	68	64	60	57	53	50	46	43	40	38	32	27	23	19	15	11									56					
58	97	95	93	90	88	85	83	80	79	77	72	68	64	61	57	54	51	47	44	42	39	33	29	24	20	16	12									58					
60	98	95	93	90	88	86	83	81	79	77	73	69	65	62	58	55	52	48	45	43	40	35	30	26	21	18	14	11								60					
62	98	95	93	91	88	86	84	81	79	78	73	69	66	62	59	56	53	49	46	43	41	36	31	27	23	19	15	12								62					
64	98	95	93	91	88	86	84	82	80	78	74	70	66	63	59	56	53	50	47	44	42	37	32	28	24	20	17	13								64					
66	98	95	93	91	89	86	84	82	80	78	74	70	67	64	60	57	51	48	45	43	38	33	29	25	21	18	15	12								66					
68	98	95	93	91	89	87	85	82	81	79	75	71	67	64	61	58	55	52	49	46	44	39	34	30	26	22	19	16	13							68					
70	98	96	93	91	89	87	85	83	81	79	75	71	68	65	61	58	55	52	50	47	44	40	35	31	27	23	20	17	14	11						70					
72	98	96	94	92	89	87	85	83	81	80	76	72	69	65	62	59	56	51	50	48	45	40	36	32	28	24	21	18	15	12						72					
74	98	96	94	92	90	87	85	83	82	80	76	72	69	66	63	60	57	54	51	48	46	41	37	33	29	25	22	19	16	13	11					74					
76	98	96	94	92	90	88	86	84	82	80	76	73	70	66	63	60	57	54	52	49	47	42	38	34	30	26	23	20	17	14	12					76					
78	98	96	94	92	90	88	86	84	82	81	77	73	70	67	64	61	58	55	52	50	47	43	38	34	30	27	24	21	18	15	13	10				78					
80	98	96	94	92	90	88	86	84	83	81	77	74	71	67	64	61	58	56	53	50	48	43	39	35	31	28	24	22	19	16	14	11				80					
82	98	96	94	92	90	88	86	84	83	81	77	74	71	68	65	62	59	56	54	51	49	44	40	36	32	29	25	22	20	17	15	12	10			82					
84	98	96	94	92	90	88	86	85	83	81	78	74	71	68	65	62	59	57	54	52	49	45	40	37	33	29	26	23	20	18	16	13	11			84					
86	98	96	94	92	91	89	87	85	83	82	78	75	72	69	66	63	60	57	55	52	50	45	41	37	34	30	27	24	21	19	16	14	12			86					
88	98	96	95	93	91	89	87	85	83	82	78	75	72	69	66	63	60	58	55	53	51	46	42	38	34	31	28	25	22	19	17	15	13			88					
90	98	97	95	93	91	89	87	85	84	82	79	76	73	69	67	64	61	58	56	53	51	47	42	39	35	32	28	26	23	20	18	16	14			90					
92	98	97	95	93	91	89	87	86	84	82	79	76	73	70	67	64	61	59	56	54	52	47	43	39	36	32	29	26	24	21	19	16	14			92					
94	99	97	95	93	91	89	88	86	84	83	79	76	73	70	67	65	62	59	57	54	52	48	44	40	36	33	30	27	24	22	19	17	15								

BLUE M EQUIPMENT



Difference Between Readings of Wet and Dry Bulbs in Degrees Fahrenheit																																																																							Dry Bulb Deg. F.
Dry Bulb Deg. F.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	22	24	26	28	30	32	34	36	38	40	45	50	55	60	70																																				
30	89	78	67	56	46	36	26	16	6	0	0																									30																																			
35	91	81	72	63	54	45	36	27	19	10	2	0																								35																																			
40	92	83	75	68	60	52	45	37	29	22	15	7	0	0																						40																																			
45	93	86	78	71	64	57	51	44	38	31	25	18	12	6	0	0																				45																																			
50	93	87	80	74	67	61	55	49	43	38	32	27	21	16	10	5	0	0																		50																																			
55	94	88	82	76	70	65	59	54	49	43	38	33	28	23	19	14	9	5	0	0																55																																			
60	94	89	83	78	73	68	63	58	53	48	43	39	34	35	26	21	17	13	9	5	0															60																																			
65	95	90	85	80	75	70	66	61	56	52	48	44	39	35	31	27	24	20	16	12	5	0														65																																			
70	95	90	86	81	77	72	68	64	59	55	51	48	44	40	36	33	29	25	22	19	12	6	0	0												70																																			
75	96	91	86	82	78	74	70	66	62	58	54	51	47	44	40	37	34	30	27	24	18	12	7	1	0											75																																			
80	96	91	87	83	79	75	72	68	64	61	57	54	50	47	44	41	38	35	32	29	23	18	12	7	3	0										80																																			
85	96	92	88	84	80	76	73	70	66	63	59	56	53	50	47	44	41	38	35	32	27	22	17	13	8	4	0	0								85																																			
90	96	92	89	85	81	78	74	71	68	65	61	58	55	52	49	47	44	41	39	36	31	26	22	17	13	9	5	1	0							90																																			
95	96	93	89	85	82	79	75	72	69	66	63	60	57	54	52	49	46	43	42	38	34	30	25	21	17	13	9	6	2	0						95																																			
100	96	93	89	86	83	80	77	73	70	68	65	62	59	56	54	51	49	46	44	41	37	33	28	24	21	17	13	10	7	4						100																																			
102	96	93	89	86	83	80	77	74	71	69	65	62	59	57	54	52	49	47	45	43	38	34	30	26												102																																			
104	96	93	90	86	83	80	77	74	71	69	65	63	60	58	55	52	50	48	46	43	39	35	31	27	23											104																																			
106	96	93	90	87	83	80	77	74	72	69	66	63	60	58	56	53	51	48	46	44	40	36	32	28	24	21										106																																			
108	96	93	90	87	84	81	78	75	72	70	66	64	61	59	56	54	51	49	47	45	41	37	33	29	26	22	19									108																																			
110	96	93	90	87	84	81	78	75	72	70	67	64	62	60	57	55	52	50	48	46	41	37	34	30	27	23	20	17								110																																			
112	96	93	90	87	84	81	78	75	73	70	67	65	62	60	57	55	53	51	49	47	42	38	35	31	28	24	21	18	15							112																																			
114	97	93	90	87	84	81	78	75	73	71	68	65	63	61	58	56	53	51	49	47	43	39	35	32	28	25	22	19	16	13						114																																			
116	97	93	90	88	84	82	79	76	74	71	68	66	63	61	59	56	54	52	50	48	44	40	36	33	29	26	24	20	17	14						116																																			
118	97	93	91	88	85	82	79	76	74	71	68	66	63	62	59	57	54	53	51	49	44	41	37	34	30	27	24	21	19	15						118																																			
120	97	94	91	88	85	82	79	77	74	72	69	66	64	62	60	57	55	53	51	49	45	41	38	34	31	28	25	22	19	16	10					120																																			
122	97	94	91	88	85	82	79	77	75	72	69	67	65	63	60	58	56	54	52	50	46	42	38	35	32	29	26	23	20	17	12					122																																			
124	97	94	91	88	85	83	80	77	75	72	70	67	65	63	61	58	56	54	52	50	46	43	39	36	33	29	27	24	21	18	13					124																																			
126	97	94	91	88	86	83	80	78	75	73	70	68	65	64	61	59	57	55	53	51	47	43	40	37	33	30	28	25	22	19	14					126																																			
128	97	94	91	89	86	83	80	78	76	73	71	68	66	64	61	59	57	55	53	52	47	44	40	37	34	31	28	25	23	20	15					128																																			
130	97	94	91	89	86	83	80	78	76	73	71	68	66	64	62	60	58	56	54	52	48	44	41	38	35	32	29	26	24	21	15					130																																			
132	97	94	92	89	86	83	81	78	76	74	71	69	67	65	62	60	58	56	54	52	49	45	42	39	35	32	30	27	24	22	16	11				132																																			
134	97	94	92	89	86	84	81	79	76	74	71	69	67	65	63	61	59	57	55	53	49	46	42	39	36	33	31	28	25	23	17	12				134																																			
136	97	94	92	89	86	84	81	79	77	74	72	69	67	65	63	61	59	57	55	53	50	46	43	40	37	34	31	28	26	24	18	13				136																																			
138	97	94	92	89	86	84	81	79	77	74	72	70	68	66	63	62	60	58	56	54	50	47	43	40	37	35	32	29	27	24	19	14				138																																			
140	97	94	92	89	87	84	81	79	77	75	72	70	68	66	64	62	60	58	56	54	51	47	44	41	38	35	33	30	27	25	19	14	10			140																																			
142	97	94	92	89	87	84	82	80	77	75	73	70	68	66	64	62	60	58	57	55	51	48	44	42	39	36	33	30	28	26	20	15	11			142																																			
144	97	95	92	89	87	84	82	80	78	75	73	71	69	67	65	63	61	59	57	55	52	48	45	42	39	36	34	31	29	26	21	16	11			144																																			
146	97	95	92	90	87	85	82	80	78	75	73	71	69	67	65	63	61	59	57	56	52	49	45	43	40	37	35	32	29	27	21	17	12			146																																			
148	97	95	92	90	87	85	82	80	78	76	73	71	69	67	65	63	61	60	58	56	53	49	46	43	40	38	35	32	30	28	22	17	13			148																																			
150	98	95	92	90	87	85	82	80	78	76	74	72	70	68	66	64	62	60	58	57	53	49	46	43	41	38	36	33	30	28	23	18	13			150																																			
152	98	95	93	90	88	85	83	81	79	76	74	72	70	68	66	64	62	60	59	57	53	50	47	44	41	39	36	33	31	29	23	19	14	10		152																																			
154	98	95	93	90	88	85	83	81	79	77	74	72	70	68	66	65	63	61	59	57	54	51	48	44	42	39	37	34	32	29	24	20	15	11		154																																			
156	98	95	93	90	88	85	83	81	79	77	74	72	71	69	67	65	63	61	59	58	54	51	48	45	42	40	37	34	32	30	24	20	15	11		156																																			
158	98	95	93	90	88	86	83	81	79	77	75	73	71	69	67	65	63	61	60	58	55	51	48	45	43	40	38	35	33	30	25	20	16	12		158																																			
160	98	95	93	90	88	86	83	81	79	77	75	73	71	69	67	65	64	62	60	58	55	52	49	46	43	41	38	35	33	31	25	21	17	13		160																																			
162	98	95	93	90	88	86	84	82	80	77	75	73	71	69	68	66	64	62	60	59	55	52	49	46	44	41	39	36	34	31	26	22	17	13		162																																			
164	98	95	93	91	88	86	84	82	80	78	75	73	72	70	68	66	64	62	61	59	56	52	49	47	44	41	39	36	34	32	26	22	18	14		164																																			
166	98	95	93	91	88	86	84	82	80	78	76	74	72	70	68	66	65	63	61	59	56	53	50	47	44	42	39	37	35	32	27	23	18	14		166																																			
168	98	95	93	91	88	86	84	82	80	78	76	74	72	70	68	67	65	63	61	60	56	53	50	47	45	42	40	37	35	33	28	23	19	15		168																																			
170	98	95	93	91	89	86	84	82	80	78	76	74	72	70	69	67	65	63	62																																																				





CENTIGRADE TABLE OF RELATIVE HUMIDITY OR PERCENT OF SATURATION

Dry Bulb Deg. C.	Difference Between Readings of Wet and Dry Bulbs in Degrees Centigrade																																				Dry Bulb Deg. C.
	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5	6	7	8	9	10	11	12	13	14	15	16	18	20	22	24	26	28	30	32	34	36	38	40				
2	92	83	75	67	59	52	43	36	27	20																									2		
4	93	85	77	70	63	56	48	41	34	28	15																								4		
6	94	87	80	73	66	60	54	47	41	35	23	11																							6		
8	94	87	81	74	68	62	56	50	45	39	28	17																							8		
10	94	88	82	76	71	65	60	54	49	44	34	23	14																						10		
12	94	89	84	78	73	68	63	58	53	48	38	30	21	12	4																				12		
14	95	90	84	79	74	69	65	60	55	51	41	33	24	16	10																				14		
16	95	90	85	81	76	71	67	62	58	54	45	37	29	21	14	7																			16		
18	95	90	86	82	78	73	69	65	61	57	49	42	35	27	20	13	6																		18		
20	96	91	87	82	78	74	70	66	62	58	51	44	36	30	23	17	11																		20		
22	96	92	87	83	79	75	72	68	64	60	53	46	40	34	27	21	16	11																	22		
24	96	92	88	85	81	77	74	70	66	63	56	49	43	37	31	26	21	14	10																24		
26	96	92	89	85	81	77	74	71	67	64	57	51	45	39	34	28	23	18	13																26		
28	96	92	89	85	82	78	75	72	68	65	59	53	47	42	37	31	26	21	17	13															28		
30	96	93	89	86	82	79	76	73	70	67	61	55	50	44	39	35	30	24	20	16	12														30		
32	96	93	90	86	83	80	77	74	71	68	62	56	51	46	41	36	32	27	23	19	15														32		
34	97	93	90	87	84	81	77	74	71	69	63	58	53	48	43	38	34	30	26	22	18	10													34		
36	97	93	90	87	84	81	78	75	72	70	64	59	54	50	45	41	36	32	28	24	21	13													36		
38	97	94	90	87	84	81	79	76	73	70	65	60	56	51	46	42	38	34	30	26	23	16	10												38		
40	97	94	91	88	85	82	79	76	74	71	66	61	57	52	48	44	40	36	32	29	25	19	13												40		
42	97	94	91	88	85	82	80	77	74	72	67	62	58	53	49	45	41	38	34	31	27	21	15												42		
44	97	94	91	88	86	83	80	77	75	73	68	63	59	54	50	47	43	39	36	32	29	23	17	12											44		
46	97	94	91	89	86	83	81	78	76	73	68	64	60	55	52	48	44	41	37	34	31	25	19	14											46		
48	97	94	92	89	86	84	81	78	76	74	69	65	61	56	53	49	45	42	39	35	33	27	21	16	12										48		
50	97	94	92	89	87	84	82	79	77	75	70	65	62	57	54	50	47	43	40	37	34	28	23	18	14										50		
52	97	94	92	89	87	84	82	79	77	75	70	66	62	58	55	51	48	44	41	38	35	30	25	20	16	11									52		
54	97	95	92	90	87	85	82	80	78	76	71	67	63	59	56	52	49	45	42	39	36	31	26	21	17	13									54		
56	97	95	92	90	87	85	83	80	78	76	72	68	64	60	57	53	50	46	43	40	38	32	27	23	19	15	11								56		
58	97	95	93	90	88	85	83	80	79	77	72	68	64	61	57	54	51	47	44	42	39	33	29	24	20	16	12								58		
60	98	95	93	90	88	86	83	81	79	77	73	69	65	62	58	55	52	48	45	43	40	35	30	26	21	18	14	11							60		
62	98	95	93	91	88	86	84	81	79	78	73	69	66	62	59	56	53	49	46	43	41	36	31	27	23	19	15	12							62		
64	98	95	93	91	88	86	84	82	80	78	74	70	68	63	59	56	53	50	47	44	42	37	32	28	24	20	17	13							64		
66	98	95	93	91	89	86	84	82	80	78	74	70	67	64	60	57	54	51	48	45	43	38	33	29	25	21	18	15	12						66		
68	98	95	93	91	89	87	85	82	81	79	75	71	67	64	61	58	55	52	49	46	44	39	34	30	26	22	19	16	13						68		
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94	99	97	95	93	91	89	88	86	84	83	79	76	73	70	67	65	62	59	57	54	52	48	44	40	36	33	30	27	24	22	19	17	15		94		
96	99	97	95	93	91	90	88	86	84	83	80																										

BLUE M EQUIPMENT



GENERAL INFORMATION, TERMS, AND CONDITIONS OF SALE

IMPROVEMENTS

Being a progressive company, we are constantly striving to improve our products. Thus, we reserve the right to offer improved models. All improved models will be equal to, or better than the original item, in our judgement.

DELIVERY AND STOCK

In some cases, units listed in the Catalog are in stock and delivery can be effected within the same day order is received. We stock hundreds of ovens and furnaces to serve you better. Wire or telephone the factory for delivery information.

SHIPMENTS

If specific shipping instructions are not given as to the method of shipping, we will determine the method which, in our judgement, will be the best for our customer.

BOXING AND PACKING

All prices quoted include cost for cartons, boxes, and packing for domestic shipments. Domestic boxing is usually suitable for export shipments by air. For overseas shipment by ocean freight, an extra nominal charge is made for such packing.

SHIPPING WEIGHTS

Shipping weights are available for each model. Every effort is made to reduce shipping weights in keeping with good shipping practice.

PRICES

All prices quoted are current and f.o.b. our Blue Island factory unless otherwise noted. We reserve the right to increase or decrease our prices. Proper notice will be issued in either case.

TERMS OF PAYMENTS

Net thirty days for all customers in U.S. and Canada after credit responsibility is established with us. For customers in other countries, we require—for the present—an irrevocable banker's Letter of Credit, preferably through a Chicago or New York bank, against which we can draw at time of shipment.

ENGINEERING SERVICE

A complete staff of competent engineers and expert mechanics are available to facilitate the design and manufacture of units to meet special applications. Prompt and courteous service extended at all times.

SPECIAL UNITS

Many customers desire modifications of standard units and/or special units designed to fit their particular application. Blue M Electric Company is well equipped to engineer and serve these needs. However, orders for modified units and/or special units are not subject to cancellation except with our consent and upon payment of reasonable charges which will indemnify us from any expenses incurred and commitments made by Blue M Electric Company.

MATERIAL CHANGES

Substituting materials due to existing conditions are sometimes necessary. We adhere to specifications shown in the Catalog. However, when substitutes are made, careful selections assure you of the best materials available for that particular application.

EXCEPTIONAL WARRANTY

For details on Blue M's unique General Parts Warranty and Replacement Service Program, please see Catalog page 12.

LOSS, DAMAGE, SHORTAGES, OR DELAY

Blue M Electric Company shall not be liable for loss, damage, detention or delay resulting from causes beyond its reasonable control or caused by fire, work stoppage, civil or military authority, restrictions of the United States Government or any department, branch, or representative thereof, insurrection or riot, embargoes, car shortages, wrecks or delays in transportation, or inability to obtain necessary labor, materials, or manufacturing facilities due to such causes. Receipt of the equipment by the purchaser upon its delivery shall constitute a waiver of all claims for delay. All damages must be reported immediately by telephone, wire or letter. Shortages in shipment must be made within 10 days of receipt of materials. Non-receipt of shipments must be reported within 10 days after receipt of invoices.

RETURNING OF EQUIPMENT

Authorization and shipping instructions for the return of any equipment or parts must be obtained by the purchaser from Blue M Electric Company offices **before** returning the equipment. Equipment must be returned with complete identification in accordance with our return authorization instructions or it will not be accepted. If a purchaser requests authorization to return equipment for reasons of his own, a restocking charge will be made plus all incoming and outgoing transportation charges paid by Blue M Electric Company.

REPAIR CHARGES

No charges for repair, replacement, etc., will be honored except when made with our written permission.

CONSEQUENTIAL DAMAGES

In no event shall Blue M Electric Company or any of its divisions be liable for consequential damages.

TAXES

The price does not include any state or local property, sales, use or privilege taxes, or any state or local taxes in lieu of the foregoing; and since any one or all of such may now or hereafter be applicable to, measured by or imposed upon the property, its sale, its value or its use, as contemplated in this offer (bid), or a contract pursuant thereto and/or the execution thereof, purchaser agrees to pay or reimburse any such taxes which Blue M Electric Company or distributors are required to pay.

AMENDMENT OF TERMS

The above terms and condition of sales are subject to withdrawal or change at any time by amendment or issuance of a new letter or policy.



USE THESE HANDY CARDS

obtain additional information and prices on any of the products in this catalog. Your request will receive our prompt attention.

Since others in your organization may also wish information, several cards have been included for their use. Naturally, additional copies of the catalog are available—without obligation—for the asking.

REMEMBER . . .

THE PRODUCTS IN THIS CATALOG ARE ONLY EXAMPLES OF BLUE M'S ABILITY TO SERVE YOU.

The units described in this catalog represent a good cross-section of Blue M's total design/manufacturing capability. And that's its purpose—to indicate broadly the kind of ability we can place at your disposal. We hope that these examples will suggest how we may be of service. Our capable engineering staff is anxious to assist you in every way. Quotations, certified blueprints, and technical information are all available at no charge or obligation. You may be assured your inquiries, as well as orders, will receive our most prompt and careful attention.

BLUE M SCIENTIFIC AND LABORATORY PRODUCTS

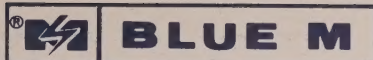
Besides the equipment described in this catalog, Blue M Electric Company manufactures hundreds of pre-engineered ovens, furnaces, baths and environmental cabinets for use in the scientific and laboratory field as well as in general industry. They are sold through a nation-wide distributor organization. The names of your nearest stocking and servicing distributors are available. Most of these are carried in stock and are available for immediate delivery. These units are described fully in our 216-page Catalog SL-178—available on request without charge. If you would like a copy, simply fill in and mail one of the handy business reply cards.

BLUE M ELECTRIC COMPANY IS A MEMBER IN GOOD STANDING WITH

1. American Society for Testing Materials (ASTM)
2. Chicago Association of Commerce and Industry (CACI)
3. Illinois Manufacturer's Association (IMA)
4. Illinois State Chamber of Commerce (ISCC)
5. Institute of Electrical and Electronic Engineers (IEEE)
6. Scientific Apparatus Makers Association (SAMA)
7. Institute of Environmental Sciences (IES)
8. National Oceanography Association

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ADVERTISEMENTS
IN ALL LEADING PUBLICATIONS**

**LOOK FOR BLUE M DISPLAYS
AT LEADING EXPOSITIONS
THROUGHOUT THE NATION**



Please send me additional information and prices on the **BLUE M** units indicated.

NAME _____

TITLE _____

COMPANY _____

STREET _____

CITY _____ STATE and ZIP CODE _____

My particular application is: _____

Please send: ☐ Technical Bulletins ☐ Catalog SL-178 ☐ Corrosion Guide

☐ Have Blue M salesman call in person



Please send me additional information and prices on the **BLUE M** units indicated.

NAME _____

TITLE _____

COMPANY _____

STREET _____

CITY _____ STATE and ZIP CODE _____

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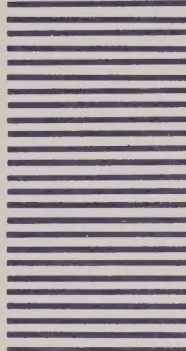
CITY _____ STATE and ZIP CODE _____

My particular application is: _____

Please send: ☐ Technical Bulletins ☐ Catalog SL-178 ☐ Corrosion Guide

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BLUE M EQUIPMENT

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CORPORATE HEADQUARTERS: BLUE ISLAND, ILLINOIS 60406
Area Code 312: Phones 385-9000 • 468-7755 • TWX: 910-689-3398

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